1893 Vol. XLVII APRIL 5th, 1945

FLIGHT

and

AIRCRAFT ENGINEER

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HIGH PRECISION HYDRAULICS

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Parade of Britain's air power

No. 6... Sunderland

The "Sunderland"—virtually a military version of the "Empire" Flying Boat—has been in continuous service since the outbreak of war. Apart from normal patrol, reconnaissance, convoy protection, and anti-submarine activity, many outstanding and unusual feats have distinguished its war-time record. The "Sunderland" has sunk and damaged many U-boats; rescued hundreds of survivors of torpedoed ships; brought to safety hundreds of persons during evacuation from Norway, Greece and Crete. "Bristol" engines have always been associated with the "Sunderland," and the latest of this famous series of Flying-Boats—"Sunderland IV"—is powered by "Bristol" Hercules sleeve valve engines.

Bristol

The single sleeve-valve principle was pioneered & developed by "Bristol"

THE BRISTOL AEROPLANE COMPANY LIMITED

FLIGHT
and
AIRCRAFT ENGINEER

FIRST AERONAUTICAL WEEKLY IN THE WORLD : FOUNDED 1909

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The Outlook

Over the Rhine

OUR commanders, including, presumably, Field Marshal Montgomery, are learning the art of using airborne troops. A good General is a scholar in his own profession, and a scholar is never too old to learn. When dealing with new weapons and new sorts of troops, knowledge often has to be gained by the method of trial and error. It is a long time since British parachutists were first dropped, experimentally, in Calabria; and if any survivors of that original body took part in the recent landing east of the Rhine, they must have rejoiced to see how the art of using airborne troops has lately progressed.

Naturally, the chief contrast has been drawn between the landings at Arnhem and at Wesel. In the first case the chance of surprise was placed before everything else, and three areas were occupied by airborne troops before the ground troops moved at all. Then Montgomery sent his armour racing up through a narrow corridor, which was frequently cut by the enemy. The armour was able to join up with the airborne men at Eindhoven and Nijmigen, but failed to reach Arnhem. In that area the airborne troops met with something like a disaster. Their heroism did not prevent heavy casualties, and secured no ground. Great risks had been taken with the narrow corridor; but finally that was made good.

In last week's operation the ground troops moved first, and moved on a broad front. That is not to say that the airborne contingent waited to hear that the crossing had been accomplished before they started; but it arrived very shortly after the ground troops were established on the east bank of the river. The two movements were almost simultaneous; but the airborne men were not left to their own resources for several days. They linked up almost immediately with the troops who had been ferried across the Rhine. The new tactics brought immediate success.

Incidentally, surprise was this time out of the question, for the Germans knew that when the 21st Army Group moved it would reach Germany at the point most favourable for invasion. But they could do nothing to stop it.

The whole operation is one more example of the fertility and flexibility of Sir Bernard Montgomery's military mind. One remembers that previous to Alamein the Germans had thought that they had established the principle that armour should lead an attack. Montgomery sent his infantry and engineers on ahead, and did not commit his armour until the way was cleared. Now either he or some superior authority has seen the desirability of reversing the methods used at Arnhem, and the result has been a resounding success.

Exports

ALTHOUGH springing from different sources, and having no direct connection, two recent announcements have points of contact in that both are designed to focus attention on that vitally important subject, British export trade. One was the formation of the British Export Trade Research Organisation (BETRO for short), and the other a Memorandum issued by the Council of the Trade and Technical Press.

The former is a plan for co-operative British market research overseas. The promoters are some 16 leading industrial companies and a number of advertising agencies. It is proposed that there should be two classes of membership: founder members and ordinary members. We might mention that the Iliffe Group of journals has applied for founder membership. It is

realised that the past attitude of "take it or leave it" will never again suffice, and the promoters point out that "efficient production will be of no avail if the goods produced for export cannot find a market. Many of our former markets have been permanently lost . . . competition will be keener than ever before . . . we shall have to obtain a detailed and intimate knowledge of the markets of the world." The market research which it is proposed to establish will be available to all members, and the results of a thorough understanding of the life, outlook and general circumstances of potential overseas customers cannot fail to be of the greatest possible value to British industry generally; we welcome the formation of BETRO wholeheartedly.

During the war the Technical and Trade Press of this country has suffered badly, largely as a result of an almost complete absence in official circles of an appreciation of its value to the nation's industries. This lack of appreciation has been responsible for the cutting of paper supplies to approximately one-fifth of pre-war consumption. Not only so, but quality of paper has deteriorated (as our readers may have noticed!). Yet vast quantities of paper have been available for books and magazines of a nature which could only be described as "tripe." There seems always to have been plenty of paper for them, while the serious technical Press has had its supplies cut to the bone.

The Memorandum sets out admirably the case for the Trade and Technical Press, and in a foreword Mr. Roland E. Dangerfield, chairman of the council, utters a portent warning: "Unless steps are taken at once, this great force for industrial revival will remain partially immobilised."

Flight is one of the journals which represent the British aircraft industries, so we may, perhaps, be forgiven for quoting from our personal experience one of many instances which indicate the value attached to our journal by the aircraft industry in connection with exports. At a Paris aero show many years ago we chided the head of one of our greatest aircraft manufacturers for not exhibiting at the Grand Palais. "Why should we?" he retorted. "One of the very detailed illustrated descriptions of our aircraft in *Flight* brings in more real business than ten Paris shows."

Before the outbreak of war, the British aircraft industry had built up a very valuable export trade in aircraft and engines, in addition to which British engines were built under licence in a number of countries. The technical aviation Press, by its world-wide circulation, served an extremely useful purpose in bringing to the notice of those foreign Government departments and ministries concerned with air matters the latest developments in British aviation. After the war there will be strenuous competition for such markets, and it is very essential that the British technical Press be enabled to represent its industry worthily. That can only be done if the powers that be realise that we *must* have more paper and more operatives in the printing and block-making trades.

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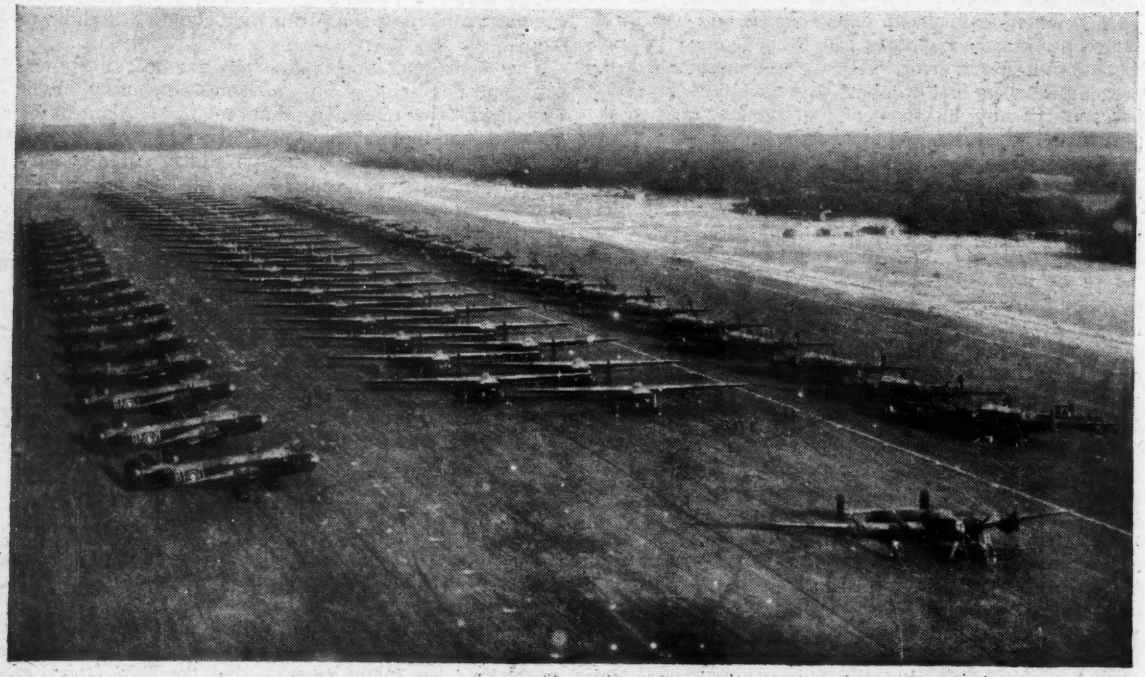
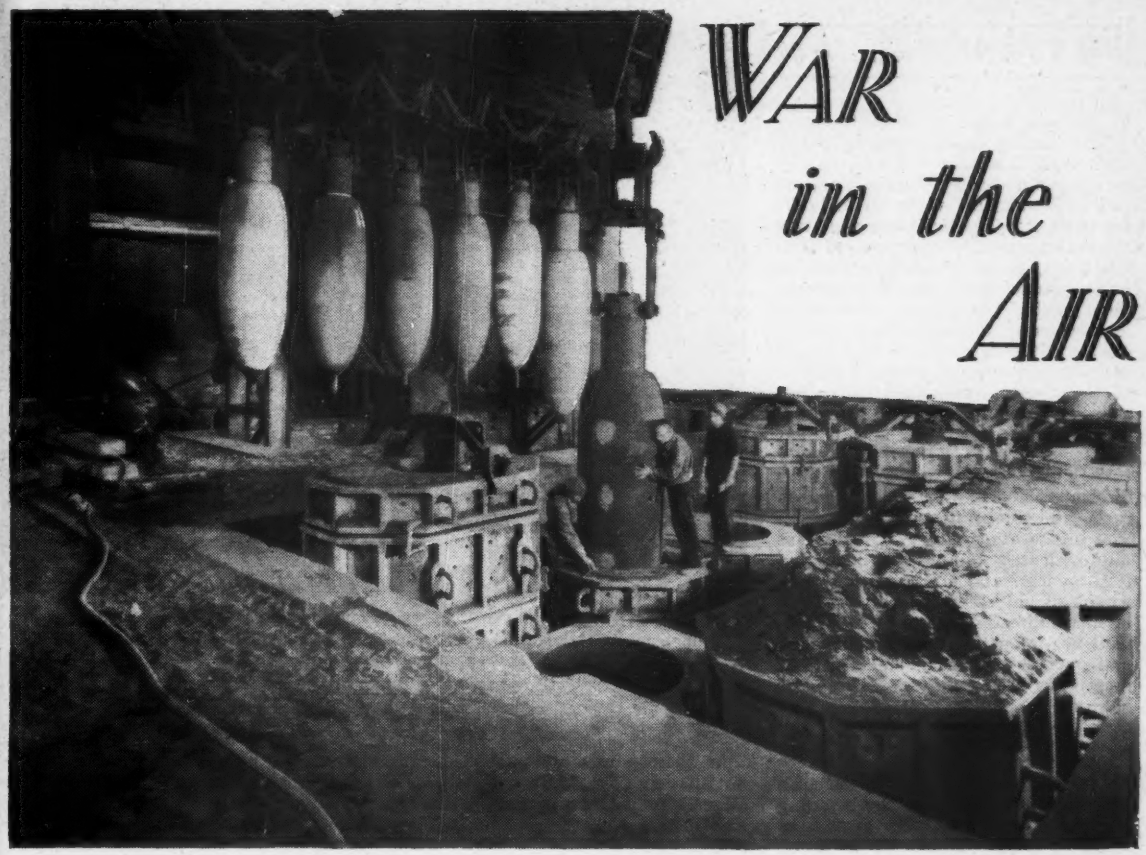


ONE OF THE MANY LINE-UPS: Halifax tugs and Hamilcar gliders, part of the vast air armada which took part in the Rhine crossings, at an airfield in England, getting ready to start.

WAR in the AIR



BIGGER AND BETTER BOMBS : The core for one of the new ten-ton bombs being lowered into the mould.

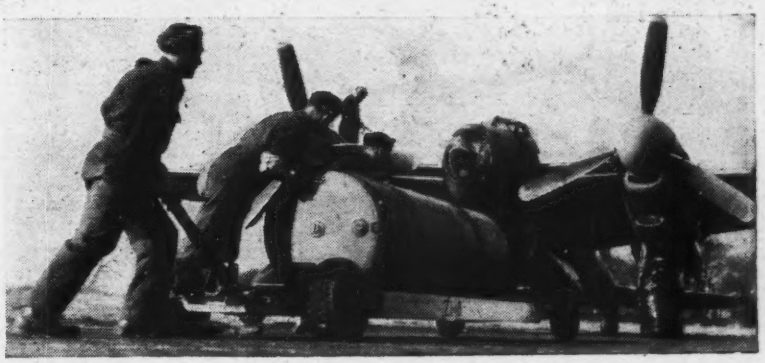
Over the Rhine : Airborne Army's Landing : 'Sealed Pattern' of Air Work : 'Jet' Bases Bombed

SO it has proved that the great smoke screen maintained for an unprecedented time over the front covered by the 21st Army Group was hiding preparations for crossing the Rhine. The Germans knew that a crossing somewhere in that neighbourhood was to be expected, but Kesselring could not guess the exact spot. On the eastern bank of the river in that area lies open country, suitable for the use of tanks and the manœuvres of large armies. In that way the country is different from that to the south, where various American armies have succeeded in making crossings, but have had to contend with unfavourable hilly country on the other side. Once again the critical spot has been entrusted by Gen. Eisenhower to Field Marshal Montgomery, under whom an American Army is, we feel sure, very proud to fight. The tough old 2nd Army, together with the Canadians, is capable of tackling the most formidable tasks.

Once more the success was a combined operation by the three Services, for the Navy manned the boats which took the men and the equipment across the river; and the U.S. Navy also supplied crews for the boats which served the 9th Army. These American sailors wore Army uniforms; one wonders why.

The Air Force part in such operations is now what soldiers call a sealed pattern. As a preliminary to the assault, every aircraft that could be mustered joined with the artillery in plastering with explosives the whole defence line of the enemy. His gun positions came in for an exceptionally heavy battering, and a special set was made against those airfields from which it was known that jet-propelled fighters have been operating. Kesselring's staff, in fact, was virtually blinded, and had no means of discovering what the movements of the Allies were until they revealed themselves.

Then, when the crossing commenced, the Tactical Air Forces stayed with the soldiers, as is their proper job, while the heavies transferred their attentions to targets further in the German rear from which reinforcements



SMALLER BUT STILL QUITE GOOD BOMBS : Loading 4,000 pounders on Mosquitoes for the sustained attacks on Berlin.

WAR IN THE AIR

of any sort might be likely to come.

The landing of the airborne troops went without a hitch. It was covered by unusual swarms of fighters, and no *Luftwaffe* machine ventured to interfere with it. The *flak*, however, was thick and accurate in places—in fact, German *flak* gunners have had so much practice that they have become very good. They know that air defence rests upon them and on nothing else, and they rise to the emergency. Nevertheless, the losses in machines of the airborne contingent were less than 3 per cent. The Air/Sea rescue boats swarmed across the Channel; but, according to early reports, only two gliders were known to have ditched. There were eight men in each, and all of them were rescued. The organisation which brought this unprecedented number of gliders and tugs together and arranged that their troops should arrive just at the right moment directly in front of the advancing infantry, and should clear paths for them, was magnificent. It must have been a most complex piece of work.

BROAD SHOULDERS FOR A HEAVY BURDEN: Air Marshal Sir Arthur Coningham was responsible for co-ordinating the entire air operations in the crossings of the Rhine. He is seen here in a zero-hour conference with, on his right, Group Capt. Sutcliffe, Chief Met. Officer, and on his left, Gen. Brereton, Commanding General of the First Allied Airborne Army, and Air Vice-Marshal Groom, Senior Air Staff Officer, Second T.A.F.

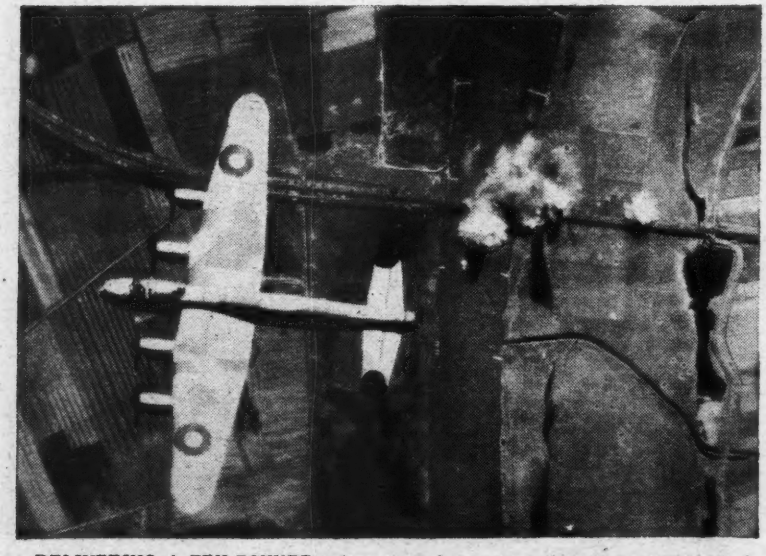
Debacle?

IN 1914, when Gen. von Kluck's Army on the right of the invading force was beaten outside Paris, the whole of the German forces fell back from the Marne to the Aisne. It looks as if Montgomery's crossing of the Rhine round Wesel has had a similar effect. The sensitive German right flank has been turned, and therefore Kesselring must have ordered a general retreat. The American 1st, 3rd, and 7th Armies are hustling the enemy on. What the position will be by the time these words are published cannot be foretold; but certainly the Rhine is no longer a barrier. Germany lies open before the pursuing Allies, and the only question which is at all disturbing at the moment of writing is whether supplies of petrol, ammunition and food can keep up with the advance.

In places our reconnaissance airmen have reported that the German retreat has begun to resemble a rout. A hurried retreat can never have been a pleasant experience for an army, even when the pursuers were armed only with lance and sabre, and when horses could only cover so many miles a day. Now, when the pursuing cavalry are in tanks and aircraft, it must be far more terrible. Kesselring had some experience of that sort of thing when he and Rommel were falling back hurriedly from Alamein. But at that time the Germans still had reasonable supplies of petrol, and were falling back on their stores. Now there is very little petrol left in all Germany; while the R.A.F. and some of the American air contingents learnt in Africa the art of keeping up with a rapidly advancing army. Moreover, the Allies now have far greater resources than ever before in the way of air transport.

On the East Front, the Russians have taken the naval base of Gdynia and forced their way into Danzig. The Russians sent up "huge air fleets" (to quote the words of a correspondent of *The Times*) which were strongly opposed by the *Luftwaffe* without much success. The German fleet tried to intervene; but the Red bombers flew out and attacked it. The carrier-borne squadrons of the Russian Baltic Fleet have frequently shown themselves to be full of energy and initiative, though their numbers cannot be large. On the southern front, too, the Russian aircraft gave splendid support to the ground troops in very fine weather.

The enemy is evidently trying hard to bring reinforcements over from Norway; but the Halifaxes of Coastal Command have been keeping a sharp look-out and have attacked many convoys in the Skagerrak.



DELIVERING A TEN-TONNER: One of the Lancasters which dropped 22,000 lb. bombs on the Arbergen railway bridge.

Air Power and the Rhine Crossing

Our War Correspondent Watches Lancasters Bombing Wesel : How it Feels to be Only 1,000 Yards from the "Receiving End"

MANY accounts have been published dealing with the opening phases of the Rhine crossings. Our accredited War Correspondent, John Yoxall, watched from a distance, which is a tribute to the accuracy of R.A.F. Bomber Command, the attacks by Lancasters on the German parachute troops in the town of Wesel. He also witnessed the passing of large sections of our airborne troops across to the dropping-zones east of the Rhine. The Luftwaffe was absent.

DURING the first two days I have had a thrilling close-up picture of air power as now fitted into the plan of battle. Air power made the Rhine crossing a possible operation, and it was the Air Command who decided the moment for the word "go" to be given. All Air Force operating in the area—Bomber Command, 8th U.S.A.A.F., 9th U.S.A.A.F., Fighter Command and 2nd T.A.F., were all placed under the command of Air Marshal Sir Arthur Coningham. Even the American Air Forces operating south of the area, down to Basle, were available on call. As I drove up to the forward areas on the Friday, the effect of air supremacy was in evidence at every turn. The greatest possible freedom of movement was being enjoyed by everyone. Football matches were going on in the fields; nobody bothered to wear steel helmets, and convoys travelled unmolested, with the vehicles nose-to-tail, despite the great plumes of dust which are a feature of this March day.

In the area within range of the German guns and mortars more precautions had, of course, to be taken. At one spot, near the banks of the Rhine, there was a notice: "You are under enemy observation for the next 60 yards. Go slowly; dust means death."

There was, however, very little activity. Occasionally Fritz would drop an odd shell or lob a mortar bomb across the Rhine. Had he known that round every corner and in every village there were crowds of assault craft, all ready for the night's operations, he could have put on a strafe with very profitable results to himself.

Lancaster Curtain-raisers

The curtain-raiser of the whole show was the daylight attack by Lancasters on the parachute troops in the town of Wesel. I watched this raid while standing in front of some infantry fox-holes, three-quarters of a mile from the target area. To outwit the enemy Radar, some T.A.F. aircraft dropped metal-foil strips a short while before the heavies arrived; and this fell all around. The drone of the heavies could be heard in the distance, but because of the heat haze in this phenomenal March weather, they did not come into sight until they were already on their bombing run.

At a guess, I would say they were flying at about 14,000ft. Suddenly (certainly before the enemy troops could have realised what was happening) the air was filled with the swish, scream and crash of falling and exploding bombs. The very ground jumped under the continual impact. Fantastic smoke and dust cloud patterns filled the air. Great spurts went up inside other previous explosions. Smoke rings of tremendous girth shot high above it all. At 5.42 p.m., exactly ten minutes after it started, the raid finished. Silence came again. A lowering sun turned the grey clouds a delicate peach colour. Unattended cows in the fields mooed to be milked. A foal and its mother stopped running in fright and settled down to crop grass by a crater which had three dead cows and a horse on its tip. The birds sang. Only man was vile.

To have stood so close to such an attack was somewhat of an experience, and I hope Bomber Command will accept it as the greatest compliment I ever hope to pay them. As the smoke spread from the target area and the contents of one Lancaster fell a trifle short, I did begin to balance discretion against valour, but I think I was too fascinated to move. The worst that happened was a gentle shower of burnt fragments which fell to earth round about me.

The curtain-raiser being over, the next item on the programme started. From every field behind me for miles around belched gun flashes, yellow and wicked. All sorts of guns were there—more than 1,000 in all. This barrage went on almost without break all through the night. Its main object was to destroy the enemy 88-millimetre guns which are used both as ground and anti-aircraft weapons. As the evening turned into night, the gun flashes appeared to become brighter and more vicious. In many directions fires on the battlefield made themselves evident. One down in the town of Xanten grew bigger the whole night through and only died down with dawn.

At 22.30 hours Bomber Command's night attack on Wesel (to assist the Commandoes) was due to start, and promptly at 22.28 a Pathfinder arrived to drop first some green target indicators and then a number of reds. If my night sound recognition is right, the Pathfinder was a Mosquito. The gun barrage inferno stopped, and the senses could be focused on the air attack. Right on the tick of 22.30 the bombing started, and to anyone who could interpret the scene it was full of interest. The target indicators showed a red glow in the sky, and each bomb went off with a great white flash.

Above the attack a close area of the sky was dotted by a large number of puffs which could be easily mistaken for an anti-aircraft barrage aimed much too low. These puffs were, of course, caused by the photoflash bombs dropped by each bomber as they photographed their bomb bursts. This is standard practice in the R.A.F. and is an exact and immediate check on bombing results. By 22.47 all the bombs were down, and one could imagine the Commandoes racing-in to deal with the Germans while they—the Germans—were still bomb happy. An unearthly silence reigned until 23.00 hours, at which time a stream of red tracer shells went their apparently leisurely way across the Rhine and the gun barrage opened up once more. That night I slept, or rather spent, under the gun barrage in what used to be a *Luftwaffe* bomb store on a bit of high ground overlooking Xanten.

Empty Bomb Stores

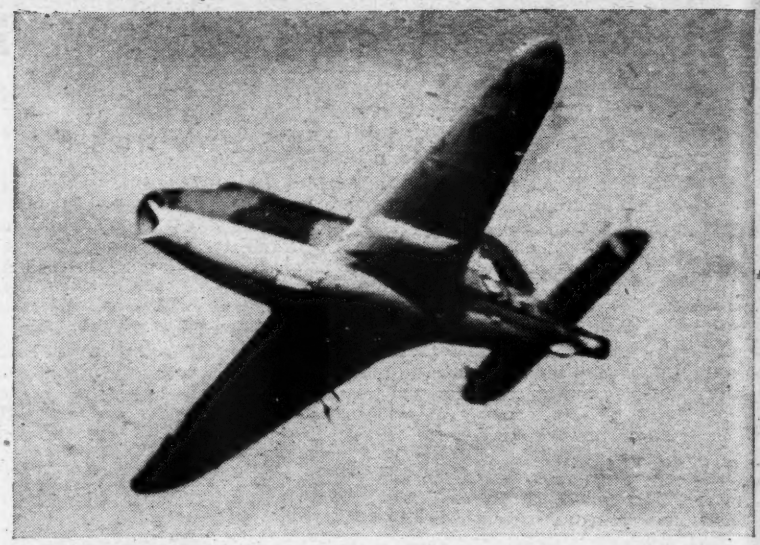
In concrete buildings above ground there were still vast numbers of papier-mâché fins for 1,000-kilo bombs, but the underground stores were empty. The continued noise and vibration from the barrage, and the absence of hip holes in concrete, made sleep impossible, and before dawn I was out again watching events from an anti-aircraft tower which the Germans had used to protect the bomb store. It did not avail them much because many of the buildings were wrecked and the remains of many Tiffy rockets were lying about.

The sun rose in a clear blue sky, and at first-light the fighter bombers of T.A.F. were already on the job of smashing up anything which showed life on the enemy side of the river. Close-support observers of the R.A.F. had gone over with the assault troops and were able to whistle-up air help wherever needed. Still the barrage went on. One wanted to scream. What it was like on the receiving end, added to bombing and gunning and rocketing by the Air Force, defeats the imagination.

At 9.50 a.m. the first aircraft of the airborne landings

(*Continued on page* 361.)

HERE AND THERE



FRISKY FOUR-YEAR OLD : First flying picture to be released of the Gloster E28/39 jet-propelled monoplane. This machine made its first flight in May, 1941, fitted with a single Whittle turbine-jet power unit.

Civil Aviation Appointment

THE King has approved the appointment of Flt. Lt. W. R. D. Perkins, M.P., as Parliamentary Secretary (designate) to the Ministry of Civil Aviation.

Mission to Yugoslavia

AIR COMDRE. A. S. G. LEE, M.C., is to be chief of Field Marshal Alexander's British Military Mission to the Yugoslav Government, with the acting rank of Air Vice-Marshal.

Fewer Sunderlands

THERE is to be a progressive closing down of production on Stirlings and Sunderlands at Short and Harland factories in Northern Ireland because of "the successful progress of the war," it has been announced.

This resulted in shop stewards in the industry in Northern Ireland deciding to send a deputation to Westminster to raise the question of alternative work for displaced aircraft workers.

Reported Missing

THE famous Liberator, *Commando*, in which Commander R. A. Brabner, Under-Secretary for Air, and other senior Air Ministry officials were travelling to Canada, was reported missing between Britain and the Azores on Tuesday of last week.

Among those travelling with Cdr. Brabner were Air Marshal Sir Peter Drummond, Air Member for Training; Sir John Abraham, Deputy Under-Secretary at the Air Ministry; and Mr. H. A. Jones, M.C., Director of Public Relations, who, after serving in the R.F.C. in the last war, became official air historian and head of the air historical branch at the Air Ministry.

Air/Sea Rescue Service, Coastal Command, and a warship joined in an immediate search, but though wreckage was reported near the *Commando's* intended track, there was no news of survivors when we went to press.

R.A.F. Centre for Croydon

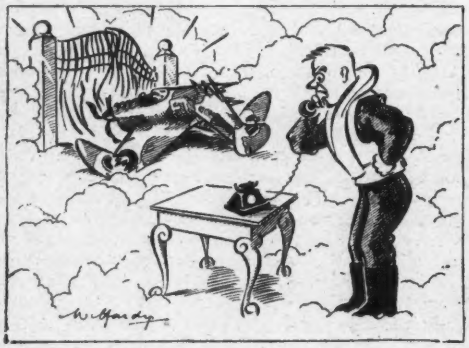
CROYDON branch of the R.A.F. Association proposes to build a recreational centre for use after the war by ex-R.A.F. and W.A.A.F. personnel.

In a letter wishing them success in their appeal, Air Chief Marshal Sir Arthur Tedder stresses the point that although the Association is doing important work in time of war, it will assume a far greater responsibility after victory has been won by helping to perpetuate that unity of purpose and service which has distinguished the R.A.F. in battle.

Death of Sir Napier Shaw

SIR NAPIER SHAW, the eminent meteorologist and formerly director of the Meteorological Office, died at his home in Old Brompton Road on Friday of last week at the age of 91.

At one time a university lecturer in experimental physics at Cambridge, and senior tutor of Emanuel College, he was responsible for many improvements in the technique of weather study and forecasting.



"It happened like this sir, — I was flying a little higher than usual —"

Last "Wings" Parade

THE closing of the Commonwealth Air Training Plan, which has turned out more than 130,000 trained airmen for the R.C.A.F. and R.A.F. in Canada, will be marked by the final "Wings Parade" at Nearby Uplands E.F.T.S. arranged to take place to-day.

The Governor-General, the Earl of Athlone, and Prime Minister Mackenzie King are expected to attend the function, according to a message received as we go to press. Cdr. Brabner and party should have attended.

Retired from Rolls-Royce

MR. W. COWEN, who has been associated with Rolls-Royce, Ltd., since its formation in 1907 and was its first sales manager in 1908, has resigned owing to reasons of health. Altogether, he has served the company and its predecessor, C. S. Rolls and Co., for 42 years, and has represented it for many years on the council of the S.M.M. & T.

Mr. Cowen was appointed general manager in 1929 and elected to the board in 1933, and, coincident with his retirement, the board has elected Mr. A. G. Elliott, the company's chief engineer, as a director. Mr. Elliott has been with Rolls-Royce since 1912.

The Second Generation

OLDER readers of *Flight* will certainly remember Mr. W. O. Manning, who was one of our pioneer aircraft designers and worked, among others, with Mr. Howard Wright on the Coventry Ordnance military biplane. Later he joined the English Electric Co. Associated with him in the latter firm was Mr. Howard Flanders, who died some years ago.

It is interesting to learn that Mr. Manning's eldest son, Sqn. Ldr. G. O. Manning, is engaged to Miss Nada Flanders, daughter of the late Mr. Howard Flanders. It is to be hoped that the second—and perhaps third—generation will continue the close association with aviation begun by their parents in the very earliest days of flying.

Two New A/Air Vice-Marshals

THE Air Ministry has announced that Air Comdre. Francis Joseph Fogarty has been appointed Air Officer in Charge of Administration at Headquarters, M.A.A.F., with the acting rank of Air Vice-Marshal; and Air. Comdre. Harold Thomas Lydford is to be Air Officer Commanding the British Forces at Aden, with the acting rank of Air Vice-Marshal.

A.V.-M. Fogarty, who is 47, has been serving as Senior Air Staff Officer at a Bomber Group since August, 1944. He enlisted in the R.F.C. as an air mechanic

HERE AND THERE

in 1917 and received his commission the same year. He was awarded the D.F.C. in 1924 for services in Iraq.

A.V-M. Lydford is 46 and has been A.O.C. a group in Technical Training Command after being employed on administrative organisation duties with the R.A.F. delegation at Washington since 1942. He joined the R.F.C. in 1916.

"They're Open!"

THE less obvious interpretation of the above phrase refers to bomb bay doors, with special reference to the fact that the quicker they can be opened and shut the shorter the time interval during which the enemy knows the aircraft is on its actual bombing run and cannot take evasive action.

In response to Army requests Boeings have engineered a new pneumatic actuating device for the bomb doors of the B-29, which flings them open in 7/10 sec. and shuts them in three seconds. The original electrically controlled system took 15 sec. to open the doors fully, and even longer to close them.

Other bomber types may also be fitted with the new mechanism.

Glider Ambulances

GLIDERS, after bringing in medical supplies from Britain to a small landing field on the east bank of the Rhine in the Remagen bridgehead, have been laden with twelve 1st Army litter-patients each and "picked-up" by U.S. transport aircraft for clearance back to the field hospital on the west bank. The casualties suffered no harm from the smooth pick-up, and it is expected eventually to evacuate more than 400 cases daily by this method.

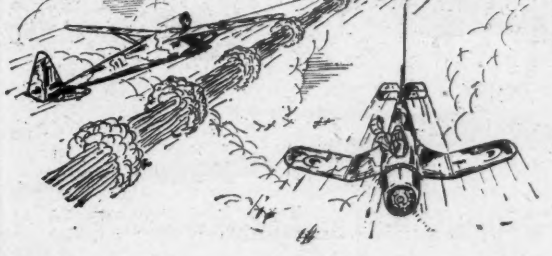
The cross-river flight lasts less than five minutes, and has the added advantage of eliminating ambulance traffic from the vital bridgehead supply roads. Ambulances are reported to have taken as much as four hours to reach the same field hospital from the front.

B-24 Into C-109

LIBERATOR bombers are now being converted into "flying tankers" at Glenn Martin's Baltimore plant by removal of all interior equipment and installing large collapsible fuel cells made of synthetic rubber or other petrol-resistant material as used in self-sealing tanks.

Developed by Martin Engineering, these cells are called "marengs" (the origin of the name will be obvious), and the flying tankers so fitted are designated C-109.

The first C-109s, used to supply fuel to B-29 squadrons based in China, were modified by the U.S.A.A.F., but the latest mareng equipment is said to incorporate several improvements.



Light U.S. Losses

U.S.A.A.F. casualty figures issued by the War Department at Washington recently showed that their aircraft losses for the Strategic Air Force in the European and Mediterranean theatres from enemy action in 1944 averaged less than two per cent. The actual figure given for the Britain-based Eighth U.S. Air Force and the 15th Air Force in Italy was 1.7 per cent.

But February last was an even better period for the heavy bombers, the loss rate among the 20,682 aircraft sent against German targets being only 0.9 per cent.

In the Mediterranean theatre, not a single heavy bomber was lost by enemy action from February 13th to 25th inclusive.

Sale of R.A.A.F. Planes

THE Commonwealth Disposals Commission has put up for sale 87 aircraft released by the R.A.A.F. They range from 90 h.p. Moth Minors to a twin-engined Douglas Dolphin flying boat.

The Moth Minors, of which there were 20 available, are 1939 models and probably represented the most appealing line for the private owner, since they use only 4 gals. an hour and cruise at 95 m.p.h. Other useful "owner-pilot" types included 23 Ryans (PT-20 type with external wire bracing), and some older Gipsy Moths with "upright" engines. A number of Fairchilds and a Beechcraft are without engines, which is rather a problem, as the machines were submitted to public tender "as is, where is," to see what sort of prices they would attract.

Incidentally, private flyers in Australia are at present allowed enough petrol to fly two hours a month.

PENETRATION IN DEPTH: This now-familiar phrase might aptly be applied to the crater made by a 22,000lb. bomb dropped on a British range during experimental tests. Note the small figure on the far brink.

Two S.L.A.E. Lectures

"POINTS arising from the Chicago Conference as they affect the Licensed Aircraft Engineer" is the title of a lecture to be given to the Society of Licensed Aircraft Engineers by Mr. T. R. Thomas, B.Sc., F.R.Ae.S., on Saturday next, April 7th. The meeting will be held at Brettenham House (south entrance), Lancaster Place, London, W.C.2, starting at 2 p.m.

The society has also arranged a meeting at Prestwick Airfield for 7 p.m. on Wednesday, April 18th, when Mr. Robert P. Urry, B.Sc.(Hon.), will give a talk on "Some General Considerations on the Problems Involved in Supercharging and High-altitude Flying."

Trade Appointments

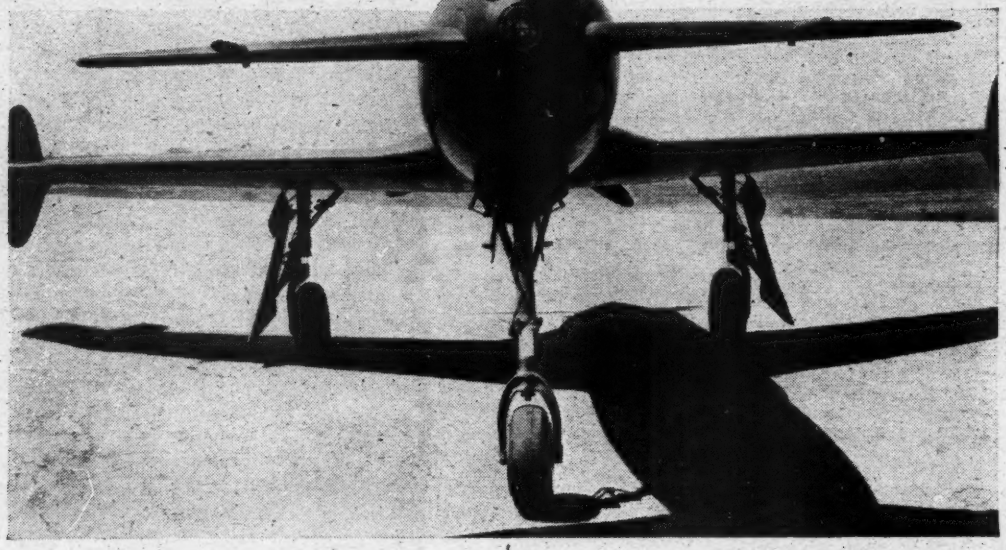
SIR PATRICK HENNESSY, who has been general manager of the Ford Motor Co., Ltd., Dagenham, for the past six years, has been elected to the board of directors as from March 21st. He joined the company at Cork after the 1914-18 war, and was subsequently appointed purchase manager of the English company. Then in 1940 he joined M.A.P. under Lord Beaverbrook and received a knighthood for his services.

* * *

Mr. E. Player, technical director of Birmid Industries, Ltd., has been appointed joint managing director of that company and also of the Birmingham Aluminium Casting Co., Ltd.—a subsidiary. He will act with Mr. Cyril C. Maudsley, who continues as chairman and joint managing director of both concerns.

D.

A Curtiss Ascender



PUZZLE CORNER : A nose-on view of the Curtiss XP-55 tail-first fighter. It is a purely experimental type and not intended to go into quantity-production.

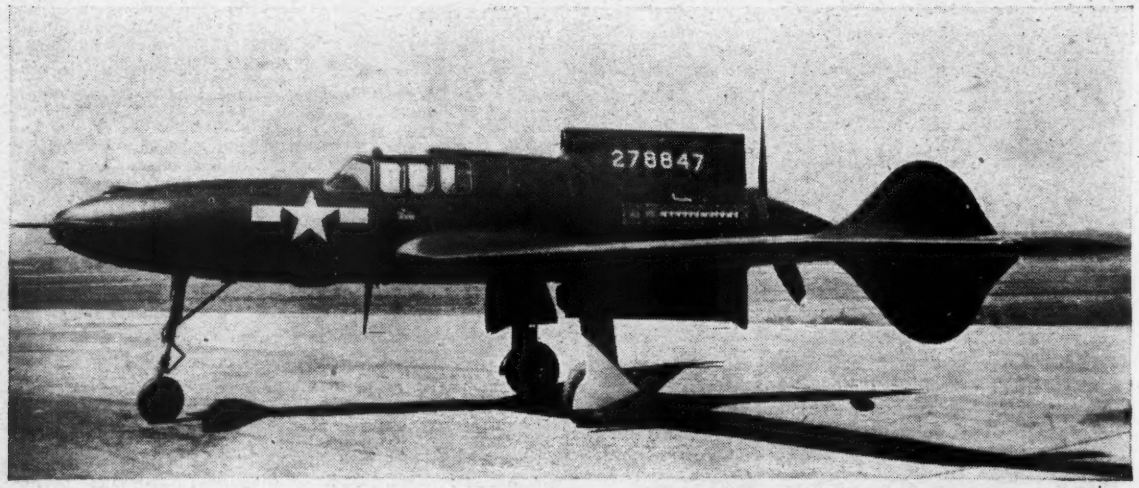
THE Curtiss XP-55 pursuit fighter was developed at the St. Louis plant of the Curtiss-Wright Airplane Division as one of a number of experimental design types for the U.S. Army Air Forces, and was flown for the first time in July, 1943, but the War Department has not approved photographs and a general description for publication until recently.

This and the other military aircraft of experimental design (see *Flight* of February 22nd, 1945) are not intended to be put into production, but according to the announcement are expected to contribute significantly to further design projects of the Air Forces. Although it bears the official numerical designation XP-55—from experimental pursuit—the machine has been given the name Ascender because of its high angle and rapid rate of climb.

By H. W. PERRY

Major design peculiarities are location of an Allison 1,275 h.p. in-line engine in the rear of the fuselage, where it drives a three-bladed Curtiss electric constant-speed pusher airscrew; a low swept-back wing mounted behind the cockpit; fully movable rudders near the tips of the wing instead of at the end of the fuselage; and an elevator at the extreme end of the nose. When in flight, therefore, the machine seems to be flying backwards, or tail-first. It is of all-metal construction and has a fully retractable tricycle-type undercarriage. The airscrew is provided with a release mechanism by means of which the pilot can jettison it in case of emergency so that the airscrew will not strike him or his parachute when he bails out.

Specific design details and performance of the XP-55 are still kept secret, but the speed is stated to equal or exceed that of aircraft of conventional design and the same horse-power, which puts it in the 400-m.p.h. class; also that the type has better longitudinal control and manœuvrability because of location of the elevator and



The long nose has been necessitated by the front wheel of the tricycle, in order to get a reasonable wheel base.

The wing-tip fins and rudders are supplemented by central fins above and below the Allison engine.

rudders. Other advantages are: improved forward and search view; less noise in the cockpit from engine exhaust and airscrew beat; increased rudder effectiveness for recovery from spins; less danger to the pilot from fire in the engine compartment; and better handling characteristics on the ground and at very high speed—because the elevators at the front are not affected by air compressibility at the rear of the wing. Another important advantage is that guns mounted in the nose fire straight forward and do not need to be synchronised to fire through the airscrew nor be limited in the firing rate.

The suggestion has been made, though not by the U.S. Air Forces nor Curtiss-Wright, that the design lends itself well to jet or turbine propulsion. That it and some of the other experimental types may have been designed with a view to such a power installation seems indicated by a recent statement made by President Guy W. Vaughan, of Curtiss-Wright, that the Wright Aeronautical Corp. was heavily committed to experimental work and production of jet and turbine engines. Another indication pointing in this direction was a description of such an application of jet propulsion as given by Dr. George W. Lewis, director of the National Advisory Committee for Aeronautics, before a sub-committee of the Military Affairs Committee of the House of Representatives, in representations made in support of a request for an appropriation of funds for research work at the N.A.C.A. laboratories at Langley Field, near Washington.

Further significance has been attached to the statement made in connection with an announcement by North American Aviation of having produced in its Inglewood, California, plant alone more than 570 Mustang fighters in January of this year, that the company was also producing at its Dallas plant in Texas "the world's fastest propeller-driven airplane." North American has also a model designated RP-64, which apparently refers to a rotating wing pursuit aircraft. If so, it surely would be unique.

The McDonnell Aircraft Corp. has developed a pusher-type aircraft designated XP-67, which is less radical than the XP-55. And the Grumman Aicraft Engineering Co., which designs and builds aircraft for the Navy (the Hellcat, Wildcat and Avenger), has built an experimental fighter assigned the official mark XP-50.

The Curtiss-Wright Airplane Division, besides developing the Ascender, has in experimental stages modifications of the P-40 and P-40 Warhawk. These are identified numerically as the 37, 42 and 46.

All of which activity is evidence that intensive efforts are being made in the United States to keep abreast at least and, it is hoped, in advance of German military aircraft development. A state of affairs which, considering manufacturing conditions, is not unlikely of fulfilment.

Air Power and the Rhine Crossing

(*Continued from page 357*)

began to pass over. Dakotas in groups of 45 made their way to the dropping-zone, each with the paratroop doors open in readiness. One or two already had parachute static lines flapping beneath the fuselage where, in the excitement of the moment, a man had jumped before reaching the dropping zone. This air panorama built up until the sky, as far as the eye could see, was filled with this great air armada. Dakotas with paratroops; towing Horsa gliders; Commandos towing two Waco CG 4A gliders each; Stirlings; Albemarles; tank-carrying Hamilcars, and supply-carrying Fortresses, all took part. There were in all some 1,500 power-driven aircraft.

From where I watched, the streams disappeared into the haze before reaching their dropping zones, and it was impossible to see at all clearly what sort of time they were having. Certainly there was no heavy *flak*, but there must have been a considerable concentration of light stuff at one period, because I counted some six or seven machines going down in flames. One, which fell in flames in Xanten, was the most lurid crash I have ever seen. In the majority of cases that I saw, the crews were able to get out by parachute, and it is safe to say that the losses, considering the number of aircraft involved and the low height at which they were flying, were very low.

Of enemy aircraft there was not a trace. Not even their jet jobs put in an appearance, but just at the point where the airborne landing was at its height—when with the T.A.F. cover and under cover added to the airborne machines there were literally thousands of Allied aircraft in the air at once—one miserable V2 made its con trail in the background.

JOHN YOXALL.

HONOURABLE RETIREMENT

WELLINGTONS of the R.A.F. Strategic Air Force in Italy recently made their last sortie as night bombers when they carried out an attack on Treviso, North Italy. They have now passed to the retired list so far as "ops" are concerned, and have been replaced by Liberators.

Their first job in this theatre was the bombing of Bengazi in 1940, and their full story, since those early days, makes a veritable "Wimpey Saga." A pre-war design, they have proved one of the war's most useful aircraft.

Relatively Safe Fuel

Fire Risks Not so Great as Thought: Flash Point the Limiting Temperature

By "BADRA"

THE subject of so-called safety fuel has again been brought before the public with the article published in *Flight* of February 1st. Since it was mentioned recently also by Sir Roy Fedden, it may be said to be now a public issue. From the nature of his work, the interest of the author of the recent article on this subject is understandable. No one who has seen some of the results on the pick of our youth, consequent on petrol fires in aircraft not using a "safe fuel," can have any doubts as to the advisability of using a fuel which would avoid burn-ups in military machines, particularly bombers, providing it can match, or nearly match, in other requirements the fuel used to-day. Unfortunately, it would seem that at this stage of the war it is already too late to avoid the thousands of casualties which have resulted from not using it. Nevertheless, in spite of all the predictions that the reciprocating engine will be superseded within the next decade or so, a case is established for a thorough investigation into the merits of what to-day are called "Safety Fuels" *for use in military aircraft*.

To use the casualties above-mentioned as an indication of the need of such a fuel in civil aircraft cannot be substantiated. Indeed, one might go a stage further and say that in the true interest of aviation, such a delicate subject as this, where over-emphasis of a remote possibility to air travellers can do so much harm, complete theoretical investigation and, if necessary, practical demonstration should be gone into before publicity is given to the subject.

Something in a Name

One of the strongest timbers in the planking of those advocating the use of "Safety Fuel" is undoubtedly the clever choice of the word "Safety" as applied to the fuel in question. It is a matter of conjecture as to the difference this might have made in the diesel battle had anyone been astute enough to use the term "Safety Fuel" in connection with it. It cannot be refuted that, judged on the only standards applicable, diesel fuel has a much better right to be termed "Safety Fuel." What are the merits of this so-called safety fuel over normal petrol in avoiding fire hazard? As the recent article pointed out the differences which may reflect in its favour are as follows:—

FUEL TYPES

FUEL	Initial and Final Boiling Point —°C.	Flash Point °C.	Approx. Spontaneous Ignition Temp. °C.
100 Octane Conventional Aviation Petrol ...	40–180	— 30	450–500
Safety Fuel (of same anti-knock performance) ...	150–220	+ 45	450–500
Diesel Oil	190–360	+ 80	300

It will be seen that in the case of safety fuel both the initial boiling point and the flash point are considerably higher than normal fuel. For the uninitiated it should be explained that petroleum fuels are composed of a number of "fractions" boiling at different temperatures, and there is thus an initial boiling-point temperature when some of the fuel will distil off before the remainder. The flash point may be defined as the temperature at which an ignitable mixture of fuel/air vapour occurs at the surface of the fuel. The spontaneous ignition temperature is no doubt self-explanatory, even though in technical phraseology it may be somewhat obtuse. It can be stated that, considering the aspects of fire risk involved, the flash point must be taken as the limiting temperature as regards fire hazard.

This statement is made on the assumption that it is impossible in the event of a crash landing to say whether or not sparks will result in the vicinity of the fuel which must be assumed to be spilt as a consequence of fracture of the tanks or fuel lines. Should a spark or flame be present, it would appear to make no difference whether normal fuel or so-called safety fuel is in use, since the temperature of such spark or flame is well above the flash point of either. It can thus be seen that if by chance no spark or flame is present, the initial boiling point and spontaneous ignition temperature of the fuel may come into the picture should a lesser heat factor, such as a hot exhaust pipe, be available. Since with the two fuels in question the figures for the latter are identical, the merit of the former rests entirely on its higher initial boiling point. To use words from the previous article to put this in plain language, "should fire occur . . . its spread will be very much less rapid and intense, because the whole area of the crash will not be immediately permeated with highly inflammable vapour." It may perhaps be advisable to say soberly that the latter part of this quotation could be a somewhat exuberant over-statement of fact! It may also be advisable to point out that 40 deg. C. (104 deg. F.) is a temperature not very familiar in our atmosphere at aircraft flying altitudes.

What are the facts of the possibility of being killed by the crashing of a civil aircraft? In order to find out, it would be necessary to have such data covering the whole world. Unfortunately, the writer is not in possession of such figures, but they are available with sufficient search no doubt. They naturally fall into two main groups, which we may call public and private flying. Furthermore, there can be no doubt that crashes in public flying are very much fewer in number than in private flying; in fact, it is well known to those interested in such data that accident figures in public air transport have been very low and tend to improve all the time. A large percentage of all public air transport is flown in the United States, and strict regulations prevail there guarding the safety of passengers. With the successful conclusion of agreements on the technical aspects of civil aviation recently at Chicago, which largely concern the safety aspects of future flying, it is safe to assume that accident figures will continue to decrease. It is therefore of interest to note the following data covering this subject, as issued by the Civil Aeronautics Authority of the U.S.A.:—

Accidents	1940	1941	1942	1943
Number of accidents ...	42	33	31	24
Miles flown per accident ...	2,590,487	4,030,990	3,551,705	4,316,727
Number of fatal accidents ...	3	4	5	2
Miles flown per fatal accident	36,266,812	33,255,670	22,020,572	51,800,722
Fatal accidents per 1,000,000 miles flown	0.03	0.03	0.05	0.02
Pilot fatalities	3	3	5	2
Miles flown per pilot fatality...	36,266,812	44,340,803	22,020,572	51,800,722
Co-pilot fatalities	3	3	5	2
Crew fatalities (other than pilot or co-pilot)	4	3	6	3
Passenger fatalities	35	35	55	22
Passenger miles flown per passenger fatality	32,784,141	42,620,991	26,814,248	74,663,484
Passenger fatalities per 100,000,000 passenger miles flown	3.05	2.35	3.73	1.34
Crew and third party fatalities	0	0	0	0
Total fatalities	45	44	71	30
Fatalities per 1,000,000 miles flown	0.41	0.33	0.64	0.29

This with reduction from 359 to 194 aircraft.

One other figure is needed to complete this picture, and that is the number of passengers flown. Over the four years shown, this figure was approximately 4,000,000 per year. It will thus be seen that in 1943 the chances of being killed whilst flying on airlines in the U.S.A. were around 180,000 to 1. Furthermore, and again quoting from 1943, a total of 24 accidents resulted in only two of them producing fatalities, the number of deaths as stated

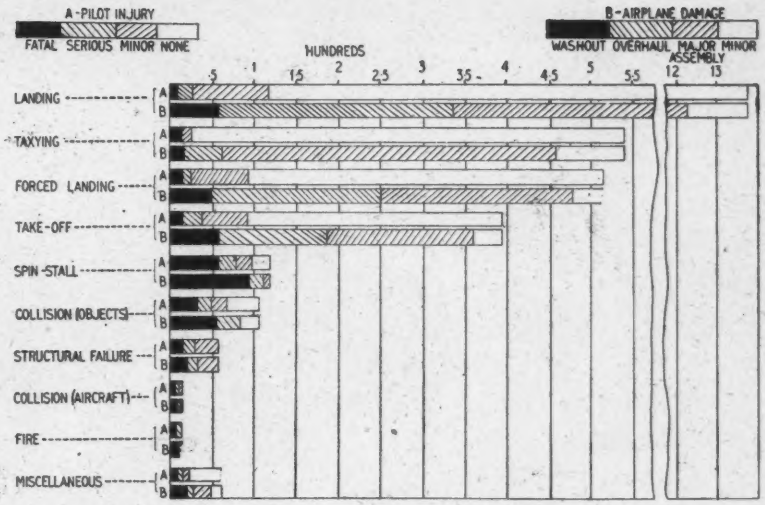
RELATIVELY SAFE FUEL

being 22. It is believed correct to say that in neither fatal accident did fire break out. In one case the aircraft flew into a mountain.

Data on private flying accidents are equally interesting on the question of fire hazard. As will be seen from the graph, of all the causes listed, fire is in the lowest category of all, being even lower than collision in the air.

The foregoing data not only supply the statistical answer to the chances of fatal accident in civil flying, but give a striking indication of the true perspective from which fire hazard should be regarded. It is indeed remote.

No intention is implied thereby that the risk from fire due to the use of conventional petroleum fuel can be ignored. Fire is rightly considered a danger which calls for calculated protection according to the risk involved. The implication of the above is that the fire risk to life in civil flying is the smallest of all risks taken and should be recognised as such. Even so, it can be stated that the earnest desire of those responsible to the air public of the future to lower the accident figures from *all* risks has caused extensive experimental work to be undertaken on the possible merit of "Relatively Safe Fuel." The probability is that as far as civil flying is concerned the results will be inconclusive. Nevertheless, in other directions where conditions are very different, it is quite possible that "Relatively Safe" will be proved a true statement.



For this analysis of non-carrier, or, as we should call them, private flying, accidents in 1942 we are indebted to the "Civil Aeronautics Journal." 3,324 accidents were reported.

B.E.T.R.O.

REALISING the vital importance of a healthy export trade after the war, some 16 British industrial concerns have combined to promote a plan for market research overseas. The plan proposes the establishment of a co-operative British Export Trade Research Organisation comprising two classes of membership: founder members, who are invited to guarantee £500 a year for three years in order to set the organisation on its feet; and ordinary members, who will pay a subscription of £100 a year. The Iliffe Group of Companies has applied for founder membership.

In the brochure which the formation committee of the organisation has prepared, the nature of the information sought is set out. There will be established overseas branches, information from which will be available to members, but in addition it is intended that specific market research shall be carried out on a cost-plus-a-fixed-percentage basis.

B.E.T.R.O. is to be registered as a company limited by guarantee and operating under Board of Trade licence. Revenue will be derived from membership subscriptions and payments for specific research.

Full particulars can be obtained from the organiser, Mr. Philip Scott, B.E.T.R.O., Georgian House, Bury Street, St. James's, London, S.W.1 (telephone: Whitehall 6062).

THE TECHNICAL PRESS

FOR the first time in history the Technical and Trade Press of Great Britain has presented a joint case to the powers-that-be. The Council of the Trade and Technical Press, which represents more than 200 British journals, has prepared a Memorandum in which some of the grievances of the Technical Press are aired, and which presents a very strong case for these grievances to be redressed. Under the chairmanship of Mr. Roland E. Dangerfield, the Council draws attention to the fact—for it is a fact—that official circles do not fully appreciate the collective importance of the Technical and Trade Press. We would go farther than that and say, from personal experience, that officialdom has a tendency to discriminate. When it wants anything from us, it is "all over us," but if we apply for permission to visit a works for the purpose of doing a serious technical article, obstacles have been put in our way on many occasions, delays have occurred for which there were no valid reasons, or we have been put off merely with the stock phrase, "the matter is under consideration."

The Memorandum explains the handicaps under which we have suffered, the chief of which is the paper rationing. Quantity has been cut to one-fifth of our pre-war consumption, and quality has deteriorated badly. If the Technical Press is to help its industries in a worthy manner it is essential that more and better paper be allotted us so that we may compete with foreign journals which are not under this handicap. Copies of the Memorandum have been sent to Ministries, M.P.s, Chambers of Commerce, Trade Associations, and heads of leading industrial concerns.

U.S. AIR AMBULANCE IMPROVEMENT

A NEW method of securing stretchers in air ambulances was recently introduced when the Fairchild C-82 Packet—popularly known as the "flying boxcar"—was being modified for the evacuation of sick and wounded patients. As a result of its success, after due confirmation by Wright Field technical experts and the U.S. Aero Medical Laboratory, the new method has now been applied to the C-46 Commando, the C-47 Skytrain, and the C-54 Skymaster when used as air ambulances.

Previously the U.S.A.A.F. used a steel structure on which to mount the litters, but the new method employs web straps for their suspension—a method which has a number of advantages over the rigid metal equipment. The latter comprised vertical tubes, anchored to floor and ceiling of the fuselage by special fittings, on which were mounted tubular cross-members with screwed fittings to hold the litters in place. This equipment was bulky and heavy, and when not in use had to be stowed in the aircraft and thus occupied valuable space. The rigid metal supports also hampered loading operations and were found to be a hindrance to flight nurses and other crew members who often had to move about while the aircraft was in flight.

As applied to the C-82, there is provision for 34 litters when secured by the new "strap suspension" method, it being possible to stack up to five litters one above the other in the slab-sided fuselage of this particular aircraft. Other aircraft with circular-sectioned fuselages are invariably limited to a maximum of four tiers. Each tier of litters is suspended from the roof of the fuselage and hooked to cargo tie-down fittings in the floor. Loops, with clamps to secure the litter handles, are spaced at the requisite intervals down the length of the web straps, and the litters are held laterally by brackets attached to the walls.

Not only does the flexibility of the webbing provide some degree of shock-absorption, but when not in use the straps can be unhooked from the floor and rolled up to the ceiling out of the way. It weighs less than half the weight of the old metal equipment, takes up less room both when stored and when in use, and makes loading and unloading far easier and quicker.

It is expected that the new "strap suspension" equipment will also be used in U.S. motor car ambulances.

Privateer PB4Y-2

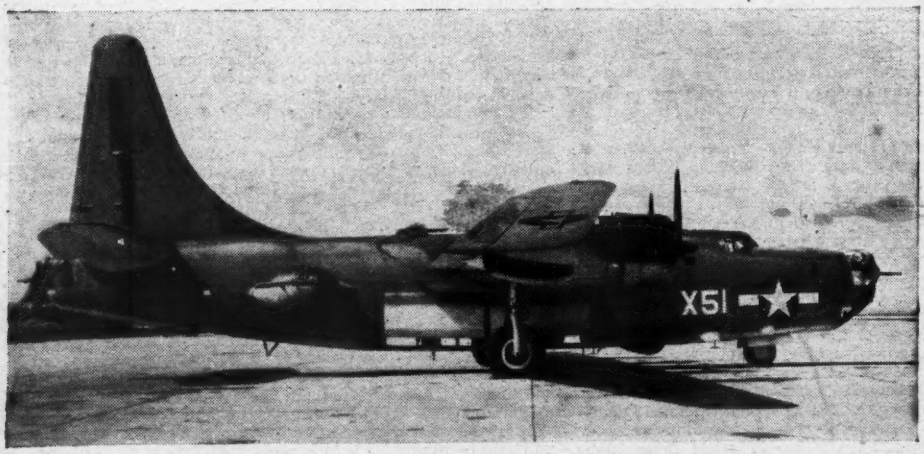
New Patrol Bomber of Liberator Parentage for U.S. Navy : New Equipment and Armament

THE Privateer, as its type designation indicates, is the second of a series of heavy land-based patrol bombers produced for the U.S. Navy by Consolidated-Vultee Aircraft Corporation. It is said that construction of the new machine has been under way for more than a year at San Diego, California.

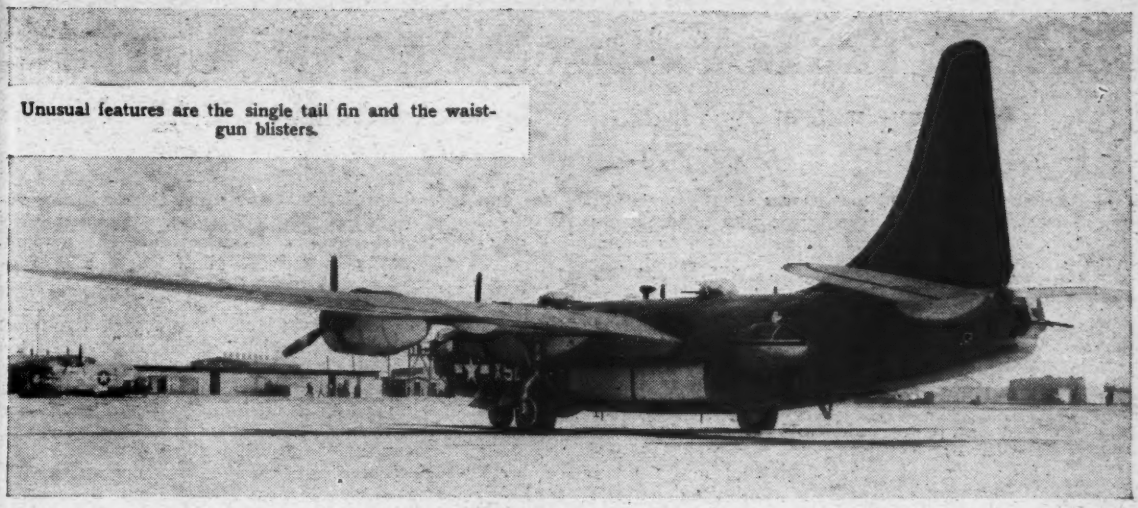
Although the first of the PB4Y series was simply a modified Liberator, the second (i.e., the Privateer) is claimed to be an entirely new design. Certainly the fuselage has been lengthened by seven feet and the fins and rudders of the Liberator have given place to a single tall rudder and fin fitted with a dorsal fillet; and these structural changes, together with different armament arrangements and different engines, do create virtually a new aircraft. However, the Liberator lineage is very apparent.

The Navy required an aircraft with greater search efficiency, more fuselage space to stow the added equipment necessary, and a different type of armament. Besides being one of the most heavily armed aircraft in the U.S. Naval Service, the makers state that the Privateer carries more equipment than any other production aircraft known to be in existence. Two of the crew of eleven are required to operate the special equipment in each machine.

All-up weight is given as between 62,000 and 65,000 lb.; maximum speed more than 250 m.p.h.; and maximum range over 3,000 miles. On normal missions the bomb bays will carry 6,000 lb. of bombs or depth charges. Twelve 0.5in. machine guns are carried—two in each of six power-operated turrets. In this connection it is interesting to note the new waist-gun blisters which, we are in-



The Privateer is claimed to carry more special equipment than any other production aircraft in existence



Unusual features are the single tail fin and the waist-gun blisters.

formed, are power operated and appear to have a fore and aft traverse. This particular arrangement is rather unusual, and we presume elevation is permitted by rotating the blister about its major axis.

The Privateer can by no means lay claim to being a "clean" aircraft, for there are protuberances of various kinds and shapes sticking out almost all over it. These, in the main, are items of the special equipment which fit the aircraft for its particular job. However, the extension of the fuselage for seven feet necessitated a compensating increase in fin area, and to provide this whilst at the same time keeping drag down the single fin and rudder arrangement was adopted. All control surfaces incidentally are fabric-covered, but the flaps are metal surfaced and retract into the inner wing panels' trailing edges.

Pratt and Whitney Twin Wasp engines of an improved type are used to power the Privateer, and, somewhat naturally in view of the fact that naval aircraft are scarcely ever high-altitude types, turbo superchargers have been dispensed with on the new engines—probably in favour of two-speed geared blowers. It is stated that the new units were designed for low fuel consumption and to give considerably more power at take-off.

Consolidated-Vultee's own hot-air system is employed for cabin heating and anti-icing. This system uses exhaust heat to warm, via heat exchangers, air which is distributed through ducts to all parts of the machine.

Production of the Privateer was preceded by the building of three prototypes, the purpose of which was to develop what is claimed to be one of the most unusual assembly tooling programmes ever undertaken in an American aircraft factory. Virtually every recent innovation for the mass production of aircraft was incorporated and, consequently, it is said that Privateer production is at the moment considered to be the most efficient aircraft manufacturing project in the world.

ROYAL AIR FORCE'S 23rd V.C.

THE KING has been graciously pleased to confer the award of the Victoria Cross on Act. Sqn. Ldr. Robert Anthony Maurice Palmer, D.F.C., R.A.F.V.R., 109 Squadron (missing) in recognition of most conspicuous bravery. This is the 23rd V.C. to be awarded in the R.A.F. during the present war.

The citation reads: "This officer has completed 110 bombing missions. Most of them involved deep penetration of heavily defended territory; many were low-level marking operations against vital targets; all were executed with tenacity, high courage and great accuracy. He first went on operations in January, 1941. He took part in the first 1,000 bomber raid against Cologne in 1942. He was one of the first pilots to drop a 4,000 lb. bomb on the Reich. It was known that he could be relied on to press home his attack whatever the opposition and to bomb with great accuracy. He was always selected, therefore, to take part in special operations against vital targets.

"The finest example of his courage and determination was on December 23rd, 1944, when he led a formation of Lancasters to attack the marshalling yards at Cologne in daylight. He had the task of marking the target, and his formation had been ordered to bomb as soon as the bombs had gone from his, the leading aircraft. The leader's duties during the final bombing run were exacting and demanded coolness and resolution. To achieve accuracy he would have to fly at an exact height and air speed on a steady course, regardless of opposition. Some minutes before the target was reached, his aircraft came under heavy anti-aircraft fire, shells burst all around, two engines were set on fire and there were flames and smoke in the nose and in the bomb bay.

"Enemy fighters now attacked in force. Sqn. Ldr. Palmer disdained the possibility of taking avoiding action. He knew that if he diverged the least bit from his course, he would be unable to utilise the special equipment to the best advantage. He was determined to complete the run and provide an accurate and easily seen aiming-point for the other bombers. He ignored the double risk of fire and explosion in his aircraft and kept on. With his engines developing unequal power, an immense effort was needed to keep the damaged aircraft on a straight course. Nevertheless, he made a perfect approach and his bombs hit the target.

"His aircraft was last seen spiralling to earth in flames. Such was the strength of the opposition that more than half of his formation failed to return. Sqn. Ldr. Palmer was an outstanding pilot. He displayed conspicuous bravery. His record of prolonged and heroic endeavour is beyond praise."

LORD SWINTON'S WARNING

WHEN Lord Swinton's attention was drawn, during an interview in Capetown recently, to a statement made in the Commons that only 1,000 Service airmen would be needed at the start for air crew duty on Britain's civil lines after the war, he said he could not give detailed figures, but people should not be too optimistic about the number that would find employment in civil flying after the war.

"It must be remembered," he said, "that although air services will be run with great frequency, the number of aircraft required would be relatively small—those needed to serve the Empire will be numbered in hundreds, not thousands.

"The British Government is giving every opportunity to men in the R.A.F. and the Fleet Air Arm to find places in civil aviation. I am afraid, however, that the numbers that can be absorbed will be small."

An Aileron Servo Unit

New System of Hydraulic Servo Assistance Which Does Not Eliminate "Feel"

IT has long been realised that sooner or later some form of assistance must be given to the pilot to supplement his muscles in actuating control surfaces. As aircraft have grown in size and speed, stick forces have also grown —not commensurately by any means, but nevertheless to such an extent that, in modern fighters at least, the stick forces have become such as to indicate clearly the growing imminence of the need.

A pilot is able to exert a far greater force on the fore and aft stick movement than on the lateral movement, this being a purely physical result of orientation—the same thing applies to the rudder control as one can exert a very large force indeed by a hefty shove with the legs. Thus, by the very nature of flying control arrangements in the cockpit, the pilot is capable of exerting only a relatively small force on the ailerons as opposed to a relatively large force on the elevators and rudder. For this reason it is clear that servo assistance is required for aileron control some time before it is necessary for the other two controls and, consonantly, to a greater degree.

The Lockheed Aircraft Corporation have spent some time in the evolution and practical development of a control power-servo system, variants of which are fitted to the C-69 Constellation and the P-38L Lightning. Gen. H. H. Arnold also disclosed recently that it is fitted to the P-80A Shooting Star, the Lockheed jet-propelled fighter which is powered with G.E.C. units developed from de Havilland jet turbines.

"Feel" With Reduced Stick Forces

One of the chief drawbacks to the evolution of a flying control power-servo system is the necessity for not eliminating "feel"; another is the necessity for maintaining control surface operation even if the servo system fails. These two factors are not easy to deal with and all the more credit is thus due to Lockheeds for the clever way in which they have surmounted the difficulties.

In essence, the pilot's control wheel provides (muscle) power input to the servo unit fitted adjacent to each aileron, and the servo steps up the power supply for aileron operation by six times. By virtue of this, pilot's "feel" is maintained as he is always supplying 1/6th of the power required to displace the ailerons, no matter what, according to the speed, that power requirement might be. Each servo unit is connected into the aircraft's hydraulic system and consists essentially of a quadrant and bell-crank assembly, a control valve, an actuating cylinder or jack, and a by-pass control assembly.

The quadrant (14) and bell-crank (12) are independently mounted on a common shaft (13) and are connected together by means of the parallel linkage (1) and the link arm (9). The quadrant has a double-flanged rim around which fits the cable from the pilot's wheel in the cockpit. A push/pull rod connects the aileron to the bell-crank and is pin jointed through bearing (11).

When the pilot moves his aileron control wheel force is applied through the cable to the quadrant, movement of which is transmitted simultaneously to the bell-crank by means of the link (9) and bearing (8), and at the same time to the control valve (2) via the parallel linkage (1). The bearing (8) is the differential medium which governs the amount of control "feel" accorded the pilot, for to this bearing are pivoted at (C) and (D) the linkages between the quadrant and the servo cylinder (3). It has been stated that the pilot always exerts 1/6th of the force required to displace the aileron and this is governed by the disposition of pins (C) and (D), the former being six times farther off-set from the bearing centre than the latter. When force is applied to the quadrant, 1/6th of the aileron load as applied through bearing (11) must be overcome before any movement of the bell-crank is obtained.

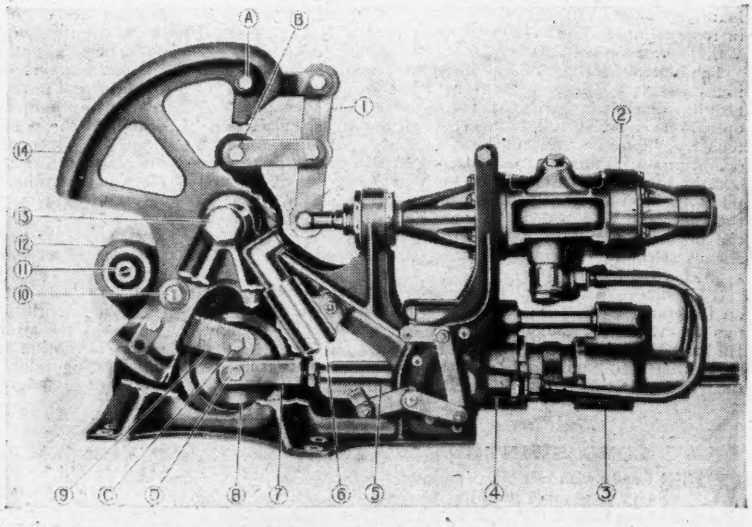
Due to the eccentricity of the link attaching centres (C) and (D) the initial movement of the quadrant is independent of the bell-crank, consequently the attachment points (A) and (B) of the parallel linkage between quadrant and bell-crank are moved relative to each other so causing the arm (1) to operate the shaft of control valve (2). This control valve is of the piston type and governs the flow of pressure and return oil to the servo cylinder (3).

Hydraulic pressure in the servo cylinder extends or contracts the rod (5) attached to link arm (7) and thus induces movement of the bearing (8) and, consonantly, of the bell-crank which is coupled direct to the aileron. Servo action will continue as long as the pilot moves his wheel enough to exert a sixth of the aileron load at the quadrant and so maintain an off-set condition at the parallel linkage.

When control wheel movement is stopped—and thus the quadrant—the servo piston will continue to move the bell-crank until the parallel linkage is returned to its original relative position, so closing the control valve. This, incidentally, traps the oil on each side of the servo piston and so holds the aileron in the obtaining position.

To provide for manual control of ailerons, which is imperative in the event of hydraulic system failure, a transfer pin (10) is fitted in the bell-crank and extends through an oversize hole in the quadrant. The diameter of this

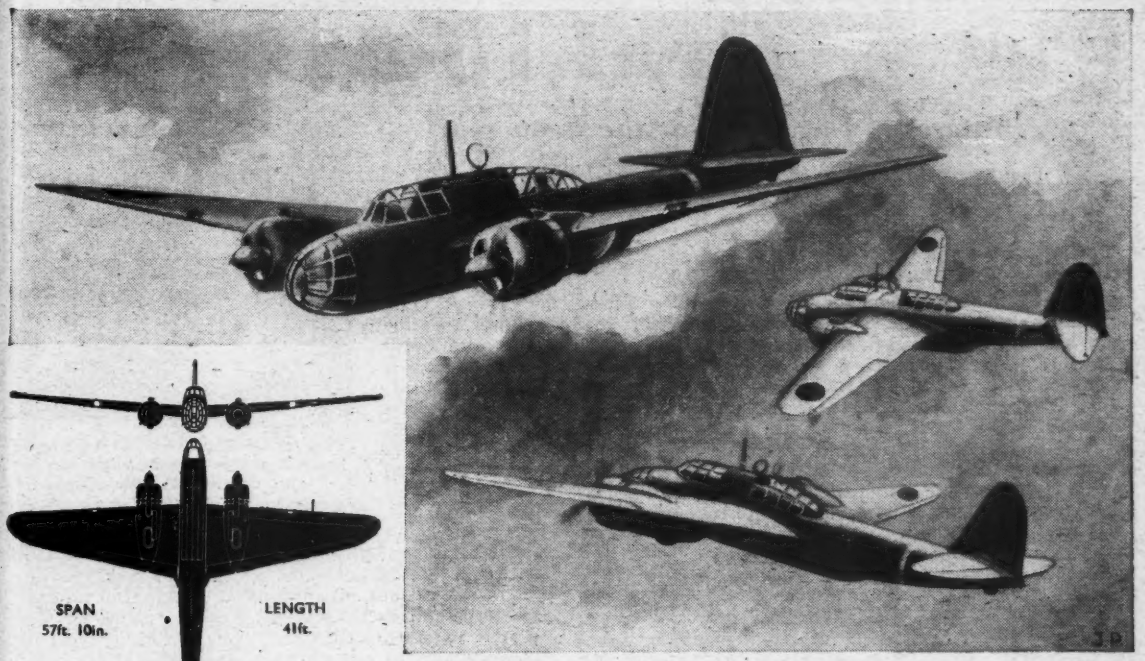
(Continued at foot of next page.)

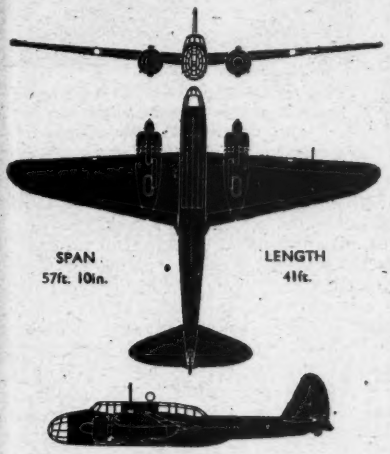


This view of a part-sectioned aileron servo unit shows the main components and will make clear the method of operation.

1. Parallel linkage. 2. Control valve. 3. Actuating cylinder. 4. By-pass valve. 5. Servo piston rod. 6. By-pass control cylinder. 7. Servo piston link. 8. Bearing. 9. Link arm. 10. Transfer pin. 11. Bearing for aileron push/pull rod. 12. Bell-crank. 13. Spindle for bell-crank and quadrant. 14. Quadrant.

Japanese Light Bomber





LILY I: With its deep glazed nose and raised top to tandem cockpits, this Kawasaki light bomber is easy to recognise. It is powered by two 950 h.p. 14-cyl. radials manufactured by Nakajima and Kawasaki, but later versions have Kawasaki type 02 engines of 1,020 h.p. and a dorsal turret at the back of the cockpit enclosure. Top speed of the version illustrated is 285 m.p.h., cruising speed 245 m.p.h. Range with an 800 lb. bomb-load is about 1,000 miles; armament comprises 7.7 mm. machine guns in nose, aft cockpit, and ventral position aft of the bomb bay.

HAWKER DESIGN-STAFF SUPPER

ON Monday, March 26th, the Hawker design staff held a supper at the Hawker Athletic Club in Kingston. This normally annual event was the first to be held since 1940, and the occasion was taken to bid farewell to Group Captain R. Horniman, who has been with the firm as Air Ministry overseer since 1939.

Mr. Sydney Camm presided, and Group Capt. P. W. S. (George) Bulman fulfilled the function of toastmaster. Group Capt. Horniman was the guest of honour, and other guests included Mr. Neville Spriggs, deputy general manager, Mr. M. Robertson, secretary, Mr. Phillip Lucas, chief test pilot, and Mr. Davies, resident technical officer.

Mr. Camm, in reply to the toast of "Hawker's," proposed by Mr. R. H. Chaplin, thanked the design staff for their efforts and their rate of output throughout the war. In particular, he mentioned the detail draughtsmen, about whom so little is generally said, but upon whose work the success of the Hawker line of single-seater fighters has so much depended. He looked forward with great confidence to the future, when, as a nation, we must always ensure that we have the best types in potential production. He took this occasion to thank Group Capt. Horniman for his very great help and support to the firm during his residence with them. The health of "The Guests" was proposed by Mr. F. H. M. Lloyd, and Group Capt. Horniman replied on their behalf.

A presentation of a scale model of the Hawker Tempest was then made to Group Capt. Horniman, on behalf of the design staff, by Mr. W. S. Hollyhock.

PUBLICITY DRIVE BY A.C.C.A.

A. M. Rochlen, director of industrial and public relations for Douglas Aircraft, has been elected national chairman of the Public Relations Advisory Committee of the Aeronautical Chamber of Commerce of America.

Mr. Rochlen succeeds L. D. Lyman, assistant to the chairman of United Aircraft Corporation, as national public relations chairman and will serve for the next six months. John E. Canaday, public relations manager for Lockheed Aircraft Corporation and chairman of the Western Regional Public Relations Committee, and J. W. Sweetser, public relations director for Curtiss-Wright and chairman of the Eastern Regional Public Relations Committee, will serve as vice-chairman of the national committee.

During the present year the programme of public information is to be intensified. The public information programme agreed upon at the February meeting embraces publication of the aviation industry's *War History, Aviation Facts and Figures* and other books, pamphlets and reports.

AN AILERON SERVO UNIT (*Continued from page 366*)

oversize hole is sufficiently larger than the pin to ensure that the pin is never in contact with the wall of the hole during normal servo operation.

A by-pass control cylinder (6) automatically opens the by-pass valve (4) on the servo cylinder should the hydraulic pressure drop below a predetermined value, and thus allows of manual control, the oil on one side of the servo piston being displaced to the other side as the piston is moved along the cylinder. There will, of course, be a certain amount of lost motion between the pilot's wheel and the aileron during manual control as the transfer pin (10) is operating in an oversize hole. The amount of lost motion, however, is said to be very little and for all practical purposes unnoticeable.

Aileron power-servo can be turned on and off by a stop cock in the cockpit, but it is inadvisable to do this in flight, unless at very low speed, owing to the sudden stress imposed on the system.

Airscrew Braking

An Interesting Method for the Economic Increase of Flying Speed and Payload

The four-bladed Escher Wyss airscrew with high-speed pitch-change control for negative thrust braking.

THE Escher Wyss Engineering Works, Ltd., of Zürich, the Swiss firm of turbine specialists, have developed a type of controllable-pitch airscrew which may serve as an aerodynamic brake when landing. Recent research and flight tests have shown that this points to a new field of aeronautical development.

Higher wing loadings have always been aimed at to increase flying speed, since only by this means can the total drag of an aircraft be reduced to the smallest possible value. In considering modern aircraft one must appreciate that the most important dimension, namely wing area, is determined by take-off and landing requirements and not by those of high-speed flight. This dependence on ground space imposes restrictions on the aircraft designer from which he finds it difficult to escape. It dictates the lift to be attained at a given speed. Thus, the maximum gross weight for a given area, i.e., wing loading, is imposed by requirements for take-off and landing.

For any given engine performance the maximum speed of the aircraft can be increased by reducing the wing area and, consequently, the drag. In spite of the detrimental effect of compressibility and the relatively large rôle played by parasitic drag, the improvement still remains very considerable, as is indicated in Fig. 1, in which the maximum speed of a certain aircraft is represented as a function of its landing speed, the following conditions being assumed:—

(a) Changes of wing loading are made by modifying the wing area, gross weight remaining constant.
(b) The aspect ratio of the wing remains constant.
(c) Parasitic drag (fuselage, tail unit, radiators) is unchanged.
(d) The maximum lift coefficient at touch-down is unchanged.
(e) The higher increase in resistance resulting from interference of wing and fuselage where smaller wings are the case is taken into consideration.
(f) The effect of compressibility on the airscrew and on the entire aircraft is taken into calculation.

Depending upon the power loading, a gain of ten to fifteen per cent. may be attained by increasing the usual landing speeds of around 80 m.p.h. (125 km/h) to about 125 m.p.h. (200 km/h). At the old landing speed, i.e., wing loading, such an improvement could be otherwise attained only by the use of a 50 per cent. more powerful engine (Fig. 2).

Hence, the advantage of the new development trend lies in the fact that both speed and range are increased at the same time without the necessity for greater engine power, that is to say, without higher fuel consumption. Thus, better flying performance is combined with greater economy.

For a given speed, increased wing loadings permit more economical flight, since for any given wing dimension the useful load may be increased. In this instance, it is not a case of the well-known fact that the proportionate share of parasitic resistance in the total drag becomes smaller, the larger the aircraft; the case in point is an increase of gross weight for a given aircraft size and flying speed. Likewise it is obvious that increased loads are not permissible without strengthening the airframe. According to the individual case, however, the proportional increase in gross weight will be substantially smaller than that of the useful load, especially as the size of the wing remains the same. In order to be free from assumptions concerning this point, we will make the unfavourable supposition that the ratio of useful load to total load remains constant with increasing gross weights. Fig. 3 shows that, in contrast with an increase in aircraft size without changing the wing loading, where the engine power (N/No) varies proportionally to the weight increase (G/Go), an increase in wing loading represents a considerable saving in power. Without braking the landing run by means of the airscrew and when the gross weight and, as assumed, the disposable load are doubled, an engine power and fuel consumption 20 per cent. higher are necessary at 280 m.p.h. (450 km/h) with an original wing loading of 30 lb./sq. ft. (150 kg/m²). At 375 m.p.h. (600 km/h) and an original wing loading 40 lb./sq. ft. (200 kg/m²) this difference actually amounts to more than 40 per cent. Owing to the theoretical assumption of an unfavourable evolution of the ratio of disposable load to gross weight, even greater economy is obtainable in reality.

It is really unnatural—as Ackeret points out—that the engine should be idle during landing. In this respect birds are well in advance of engineering; at the moment of landing they display the greatest effort, hence they require no landing run and can land on a twig.

The extraordinary effectiveness of the airscrew as a landing brake, borne out by measurement in numerous trials, and in particular the possibility of reducing the landing run of certain aircraft types to less than one-third of the normal length, are facts which are not surprising when examined more closely.

The airscrew is capable of developing braking forces of the same order as those of the starting thrust (with negative sign: Fig. 7).

Unlike wheel brakes, which, when too powerfully applied, produce a tendency for the aircraft to nose over, the braking force of the airscrew has prac-

ALTHOUGH modern developments in the aeronautical field have made it possible to build aircraft capable of carrying a heavy payload at high speed, the problem of the necessary take-off and landing distances imposes a severe constriction on the operation of such aircraft. Economic conditions make it eminently desirable that high wing loadings should be employed, yet high loadings are incompatible with modest size airfields.

We reproduce herewith an article which formed a special supplement to the January 20th issue of Interavia and which sets out the advantages to be obtained from the use of reversible-pitch braking airscrews. The article deals with the Escher Wyss (Swiss) airscrew, and this company makes the claim of having originated the idea. British airscrew manufacturers are by no means behind-hand in this development, and our readers can be assured that they may well see British aircraft so equipped flying within the very near future.

tically no influence on the centre of gravity. Especially towards the end of the landing run, when ordinarily the danger of nosing over with wheel brakes increases steadily until a stop is reached, the braking airscrew furnishes an effective stabilising component. This characteristic permits a more intense application of the wheel brakes, if necessary, than has hitherto been possible.

Furthermore, the lift of the main plane section exposed to the slipstream of the airscrew is considerably reduced. As soon as the airscrew acts as a brake, the slipstream is reversed and flows forwards. As a result, within the slipstream the air speed is practically zero, so that the lift of the wing section exposed to the slipstream disappears for all practical purposes (Fig. 6). This fact is of the greatest importance. At the beginning of a normal landing without airscrew braking, the wheel loading is zero, since at that moment the wing lift exactly equals the gross weight. At this point the wheel brakes are entirely ineffective. But when the airscrew is used for braking, the full airscrew braking force is available from the moment of touch-down; in fact, this force is greater at the initial point of landing than at the end. Since a large proportion of the wing lift is "wiped out" by the braking airscrew a certain wheel loading is likewise present from the beginning. Consequently, wheel braking is also effective from the point of touch-down. This mutual effect explains the apparently surprisingly great braking efficiency of the airscrew (Fig. 4).

Smaller airfields—which might be situated, for example, nearer the centres of large cities—are thus made available also to the faster types of aircraft. In this connection it may be recalled that the practical adoption of braking by means of the airscrew was first realised in Switzerland, i.e., in an essentially mountainous country, where construction of big airfields meets with numerous difficulties. The new development is of undeniable value in other special types of operation, e.g., in the case of aircraft carriers, where the length of the flight deck is also extremely limited.

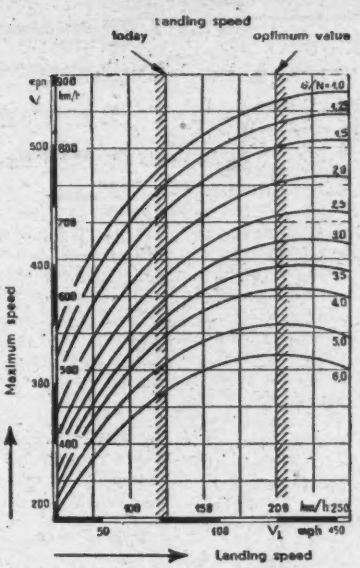


Fig. 1. Higher landing speed permits an increase in top speed as well as range without requiring more powerful engines or increased fuel consumption. G=Gross weight, kg. V_L=Landing speed. N = Engine output h.p. V=Maximum speed. (G/N constant.)

Cases in which the size of airfields is very limited are, fortunately, rather the exception. However, by using the airscrews as a landing brake it will be possible to build aircraft to land on runways of the same or even shorter lengths, yet at a considerably higher touch-down speed. Thus it will be possible to increase substantially the wing loading.

This in turn will make it possible to increase either the flying speed or the payload, or both together, as indicated in the first section of this article. An example of the application of this principle appears in Fig. 5, showing the landing run of an aircraft with high landing speed and correspondingly heavy wing loading.

With conventional aircraft, landing is still a delicate manœuvre requiring considerable concentration on the part of the pilot. The following conditions must simultaneously be fulfilled at the moment of touch-down:—

The machine must contact the runway on the chosen spot.

It must have exactly the minimum flying speed.

It must make a three-point landing, i.e., it must touch down at the correct angle.

If the landing speed is too low, the aircraft is faced with loss of speed and all its evil consequences; but landing at too high a speed is equally dangerous. After touching down the aircraft has a tendency to rise again, since in the taxying position it has a lift exceeding its weight. Furthermore, for conventional aircraft the landing run distance rapidly grows with increasing landing speed. (In first approximation the landing run is proportional to the square of the touching-down speed.)

High-speed Landings

Thus, in machines with high landing speeds, the designer is faced with the problem of the resultant greater delicacy and hazard of landing manœuvre. It is not the increased speed itself which represents the greatest risk; the real

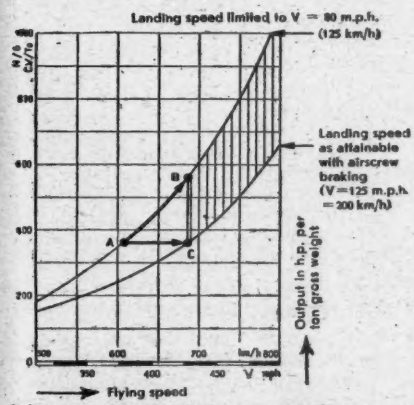

Landing speed limited to V = 80 m.p.h. (125 km/h)
Landing speed as attainable with airscrew braking (V=125 m.p.h. =200 km/h)
A
B
C
Output in h.p. per ton gross weight
Flying speed
N/G = Output in h.p. per ton gross weight.

Fig. 2. Higher top speed for unchanged payload. Assuming an upper limit to landing speed, the increase A B in flying speed could be attained only by a 50 per cent. increase in power and fuel consumption; as seen at A C, this may be attained without higher power by using the airscrew as a landing brake.

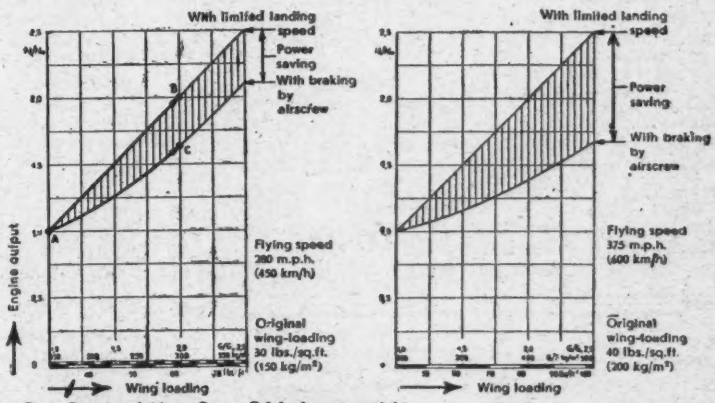

With limited landing speed
Power saving
With braking by airscrew
Flying speed 280 m.p.h. (450 km/h)
Original wing-loading 30 lbs./sq.ft. (150 kg/m²)
Engine output
Wing loading
With limited landing speed
Power saving
With braking by airscrew
Flying speed 375 m.p.h. (600 km/h)
Original wing-loading 40 lbs./sq.ft. (200 kg/m²)
Wing loading
G = Gross weight. G₀ = Original gross weight.
N = Engine power. N₀ = Original engine power. G/F = Wing-loading.

Fig. 3. Greater payload for unchanged flying speed. If the disposable load were doubled at present landing speeds, an aircraft would require at least 20 to 40 per cent. greater power and fuel consumption than one with increased wing loading and a reversible-pitch airscrew for a landing brake. Without airscrew braking the necessary power increases from A to B; with it, it increases from A to C. Moreover, the unfavourable assumption is made here that the empty weight of the aircraft increases proportionally to the disposable load when the wing loading is increased.

AIRSCREW BRAKING

danger lies in the accompanying phenomena hitherto inseparable from high landing speeds, namely:—

Loss of speed which always threatens to occur in the direct vicinity of the minimum speed and which tends to have far worse consequences when the absolute value of the minimum speed is high.

The fact that the length of landing run becomes inadmissibly great when alighting at higher speeds.

These disadvantages are entirely eliminated by the use of the airscrew as a brake, which at the same time greatly simplifies the landing manœuvre. In landings involving the use of the airscrew as a brake, the aircraft can certainly make three-point touch-downs, but it can equally make contact with the main wheels first or with the tail wheel first, without tendency to rise again or to nose over. The risk of a stall can thus be eliminated by the simplest method, namely, by landing at a speed considerably in excess of the minimum speed. Any increase in the length of the landing run is minimal, and there is no danger of nosing over or bouncing. This is due to the fact that the lift of the wing section situated within the airscrew slipstream is practically removed by the braking airscrew. The pilot chooses his course in such a manner as to contact the airfield at the desired point and changes the airscrew pitch control to the negative pitch position. At the moment of touch-down he gives full throttle, so that the brake effect is instantaneous and substantial.

Two Decisive Advantages

Compared with nose wheel landing gears, braking with the airscrew shows two decisive advantages:—

In landings at speeds exceeding the minimum speed which must, of necessity, become a rule to ensure against stalling in the case of aircraft with high landing speeds, the landing run increase is negligible.

The braking force is completely independent of the nature of the ground, so that airscrew braking retains its effectiveness on wet or snow-covered fields.

The most favourable solution seems to be to combine airscrew braking and tricycle landing gear wherever the greater weight of the latter, compared with conventional undercarriages, can be justified.

Now that the question of faster landing may be regarded as solved by the practical introduction of airscrew braking, the problem of take-off is to be considered.

It lies in the nature of things that any increase in wing loading for a constant maximum lift coefficient necessitates increased take-off speed and consequently a longer take-off run.

Research, model and full-scale flying tests carried out by Escher Wyss have shown that the conventional airscrew-engine combination is still capable of substantially improving take-off. Correct utilisation of the engine and suitable design of the airscrew permit an increase in take-off thrust sufficient to ensure the take-off of the most heavily loaded aircraft (Fig. 7). The potential improvement is so great that, depending upon the data of the type involved, it is possible to reduce the take-off length to between two-thirds and one-half of the original value. That the reduction in

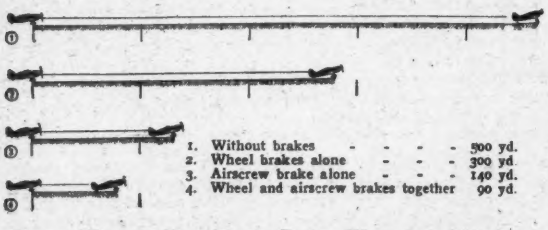

1. Without brakes - - - - 500 yd.
2. Wheel brakes alone - - - 300 yd.
3. Airscrew brake alone - - - 140 yd.
4. Wheel and airscrew brakes together 90 yd.

Fig. 4. Test results with the Escher Wyss reversible-pitch airscrew. Braking by means of the airscrew alone reduces to less than a half the landing run otherwise necessary with wheel braking.

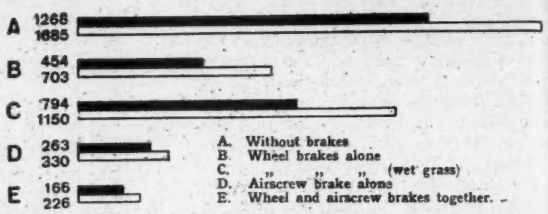


Fig. 5. Landing run with higher wing loading and overspeed. Black: Normal landings. (V_L=125 m.p.h.=200 km/h.) White: Landings at overspeed. (V_L=150 m.p.h.=240km/h.)

take-off is greater than the thrust improvement (S_m) is explained by the physical dependence of the factors involved in starting procedure, as expressed in the simplified formula:—

$$s=\frac{G/F}{\gamma Ca_A(S_m/G-\mu)}$$

(in which s=length of take-off run, G/F=wing loading, γ=specific gravity of the air, Ca_A=take-off lift coefficient. μ=coefficient of wheel friction, G=gross weight, S_m=mean take-off thrust of the airscrew). It may be seen that in the part of the denominator between the brackets there is a difference, so that any increase in the thrust coefficient, S_m/G, may result in a further decrease in the length of the take-off run "s." The fact that there still exists at all a possibility for improving airscrew thrust at take-off is due to the circumstance that, hitherto, endeavours to increase efficiency have aimed at improving the efficiency of high-speed flying or cruising.

In order to increase airscrew thrust in the take-off region the following possibilities are available:—

The increase in solidity of the airscrew, i.e., increase of the number of blades and use of wider blades, is the most efficient method.

During take-off, temporary overloading of the engine by means of increased boost pressure.

During take-off, operating the engine temporarily at an increased r.p.m.

In high-speed flight, operating the engine at a speed slightly below the nominal r.p.m., which permits the use of an airscrew of somewhat greater diameter.

These improvements are sufficient to assure the take-off of the most heavily loaded aircraft without external take-off aid—i.e., solely with conventional and readily available measures affecting engine and airscrew—with a short take-off run corresponding to the airscrew-braked landing run.

Modern airscrews require a pitch range of from 30 deg. to 40 deg. for automatic constant-speed operation. Adjustments then occur between angles of from approximately +20 deg. (take-off position) to +50 deg. or +60 deg. (high-speed flying position). Now, if the airscrew is to be used as a brake, negative pitch angles of −15 deg. or −20 deg. must be selected. Hence, in an airscrew capable of being used for braking the total pitch angle range must be at least 65 deg. to 75 deg. exclusive of any feathering range.

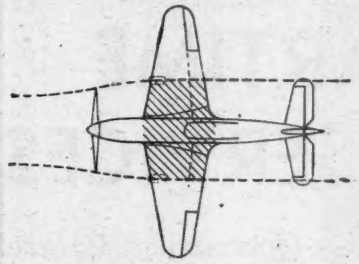
At the same time, means must be found to prevent an inadvertent change of the blades to braking pitch during normal flight, as otherwise serious accidents might occur. This problem has been solved by Escher Wyss with the aid of an automatic locking device.

Great Braking Forces

The magnitude of the braking forces that may be produced by the airscrew offers a further difficulty. As indicated in Fig. 7, the braking force of the airscrew grows rapidly with increasing speed. At the landing speed of fast aircraft it can amount to more than the static thrust (with negative sign). Forces of this magnitude require a high bending strength of the airscrew blades. Moreover, they necessitate a high degree of material strength and rigidity of the blade mounting, the airscrew hub and the pitch control mechanism, in order to guarantee reliable operation of the pitch control in the varying circumstances.

In principle it is probably quite possible to use as landing brakes airscrews possessing low pitch-changing speed. In

AIRSCREW BRAKING



Engine power: 1,000 h.p.
A, E, Normal three-blade airscrew.
B. Four-blade airscrew with wide blades.
C. Normal three blade airscrew with extra take-off boost, temporary excessive engine r.p.m. and increased airscrew diameter.
D. F. Four-blade airscrew with wide blades, with extra take-off boost, temporary excessive r.p.m. and increased airscrew diameter.

Fig. 6. During braking the lift of the shaded section of the wing is eliminated by the fact that the airscrew reverses the airflow. This facilitates the landing by permitting landing at overspeed without risk, and increases the effectiveness of the wheel brakes.

such cases the airscrew must be set at braking pitch long before the point of landing is reached, with the engine idling. (At landing speeds common to-day, a minute corresponds to a distance of from 2 to 2.5 miles = 3 or 4 kilometres.) But in this condition the aircraft is completely helpless against external influence (squalls, cross winds, erroneous estimation of distance by the pilot, etc.); nor can it take off again should there be an unforeseen obstacle in its way. Braking with this type of airscrew is, therefore, an extremely dangerous proposition and could never be introduced into the commercial air services. It is only by the extremely rapid change of the blade angle to braking pitch and equally rapid return from the braking angle to the normal pitch range that it is possible to utilise the advantages of airscrew braking without sacrifice of operational safety or manœuvrability.

The change-over of the blades to braking pitch must not be effected earlier than the moment when the success of the landing can be taken for granted, i.e., at the earliest from 300ft. to 150ft. (100 m to 50 m) before the touch-down. Consequently, the time required for the process of pitch change must not exceed one or two seconds. The transition from the finest pitch of the normal range to braking pitch (from about +20 deg. to about −20 deg.) must hence take place at a minimum velocity of at least 20 deg. per second. The same pitch-changing speed must also be made available for returning the blades to positive pitch, in case the pilot is forced to take off again for one reason or another.

High pitch-changing speeds are required also because in the course of the change to the braking position the blades traverse pitch angles at which the airscrew may be accelerated by the airstream, which easily might produce dangerous racing of the engine. However, this windmilling effect disappears just as suddenly as it arises, as soon as the airscrew blades reach a sufficiently coarse negative angle of incidence. For this reason quick pitch change while setting the blades at the braking angle with the aircraft still moving forward is the only means of preventing excessive revolutions: the inertia of the revolving masses will then

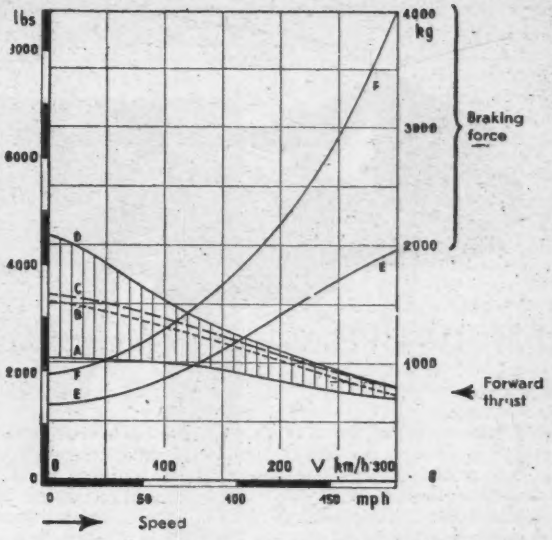


Fig. 7. The braking power (E, F) is great and reaches maximum efficiency at high-speed touch-downs, whilst the wheel-brake efficiency is zero at the moment of ground contact. Increasing the take-off thrust from A to D results in a shortened take-off run without external aid, corresponding to the shorter landing-run with airscrew braking.

prevent the engine speed from rising to inadmissible values.

The attainment of sufficiently high velocities of pitch variation has been an insuperable obstacle with airscrew types so far in use, since the latter are incapable of producing instantly the output required for pitch variation.

The power of the pitch control motor amounts, as an example, to one-fourth or one-half horse power for a pitch-changing speed of between one and two degrees per second in the case of conventional electric airscrews. Thus, if it were desired to raise the pitch-changing velocity to 30 deg. per second, an output of from 7½ to 15 horse power would be required, assuming equal efficiency of the power transmission. It will hardly be possible to build electric motors of ten or twenty horse power into the hub of an airscrew, not to mention the reduction gears, worm gears and gear wheels otherwise necessary for the transmission of the pitch changing energy. Hydraulic servo-motors are good sources of direct power, without their energy being first absorbed, after starting, for the acceleration of intermediate components.

However, the change-over from electric or mechanical to hydraulic operation alone is not sufficient. Another step is required in order to realise short period maximum pitch-changing velocities by means of a simple and compact hydraulic power unit. The solution consists of the insertion of a pneumatic power accumulator to supply the power to the control mechanism. In this way it is possible to dimension the governor of the airscrew on the basis of the low power involved in normal pitch control (1 to 1.5 h.p.). Otherwise the hydraulic oil pump would have to be designed for the output required for high velocity changes (15 to 20 h.p.).

AUSTRALIAN FIGHTER WING IN EUROPE

AUSTRALIA'S first fighter wing in Europe has recently been formed. One of the R.A.A.F. squadrons forming the new wing was previously employed on precision bombing of V-weapon targets in occupied territory.

The Australian fighter wing, at present based in Britain, is to be commanded by Wing Commander Donald George Andrews, D.F.C., of the R.A.A.F., who comes from Southport, Queensland, where in civil life he was a bank official.

Wing Commander Andrews enlisted in the R.A.A.F. on November 8, 1940, and reached Britain in August, 1941. He was posted to a Hurricane squadron, served as a night fighter pilot, and took part in the combined operations at Dieppe.

PATHFINDING TO PEACE

AIR VICE-MARSHAL D. C. T. BENNETT, Chief of Bomber Command Pathfinders, has accepted the invitation of the West Middlesbrough Liberal Association to be their candidate in the by-election caused by the death of Mr. Harcourt Johnstone.

A.V-M. Bennett has just published a book, "Freedom from War," which sets forth his plan for establishing in the world the rule of law.

"Political inertia is the only really serious obstacle," he says, "to the establishment of permanent peace at the end of this war. This must be overcome by the advent of new blood in the political machine of the world."

B.O.A.C. WARTIME SERVICES

Part IV—Widespread Organisation : Traffic Results : Government Control

By V. L. GRUBERG

THE efforts of the B.O.A.C. to keep open vital Commonwealth air services under the difficulties of war conditions were described in rough outlines in the past three issues of *Flight*. The organisation which is behind these achievements is essentially as complex as its operations. Its bases are the four main departments: (1) Technical. (2) Administration. (3) Commercial. (4) Finance and Accounts. The G.H.Q. is in London.

The operational set-up of the B.O.A.C. is based on the "line" or "route" each under a superintendent, who in turn is responsible to the regional director, the local representative of the director-general in charge of a region. Of these there are six: *The European Region*, with H.Q. in London, covering the U.K. and Eire, Europe, Iceland, the Azores, Africa north of the Belgian Congo and west of Sudan with Libya and Tunisia; *Indian and Burma Region*, with H.Q. at Karachi, covering India and Burma, the Persian Gulf as far north as Bahrein (including the Oman and Hadromaut Coast as far west as Salalah), and Ceylon; the *Middle East Region*, with H.Q. at Cairo, embracing the Sudan, Egypt, Palestine, Syria, Turkey, Iran, Iraq, Abyssinia, and Arabia (up to Bahrein and the Hadromaut Coast); the *Central African Region*, at Nairobi, comprising Kenya, Uganda, and Tanganyika, with responsibility for service to Madagascar; the *South African Region*, with H.Q. at Durban, covering, in addition to the Union, the Belgian Congo, the Rhodesias, Nyasaland, Portuguese East and West Africa; and last but not least, the *West Atlantic Region*, centred on Baltimore, and covering the North and South American continents, Greenland, the West Indies, and other islands off the coast of the American continents.

If the picture in the past instalments was confined to the nature of B.O.A.C. services, operational results, as represented by dry figures, are not less impressive. The pictorial diagrams show the volume of traffic for passengers, freight and mail. The upward trend is further illustrated by the following percentage increases in the volume of traffic in each case compared with the preceding year:—

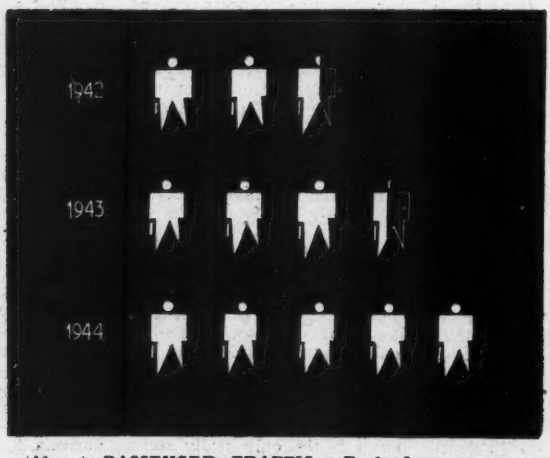
	1943	1944
Miles flown	25.2	49.6
Freight (tons)	85.8	69.5
Passengers carried	31.7	51.5
Mail (tons)	16.3	51.4
Capacity ton-miles	85.8	69.5

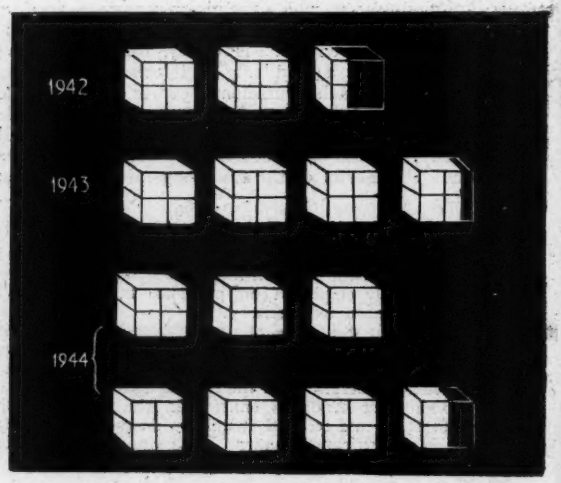
It is interesting to note that whilst freight tonnage carried in 1943 showed an increase of 85 per cent. over that of 1942, when expressed in ton-miles the increase was only 65 per cent. The 1944 results compared with 1943 show the same rate of increase of ton-miles, but a 69.5 per cent. increase of tons carried. Mail shows by 1943 an increase of 16.3 per cent. as compared with 1942, but a decrease in ton-miles of 6.8 per cent.

Trends of Traffic

About half of the total traffic volume in the years 1942, 1943 and 1944 was represented by passenger movement. In this respect wartime proportions closely approximate the results of 1937, when 47 per cent. of the total British ton-miles flown was taken up by passenger traffic.

A good indication of the development trend of operations is the factor of operational intensity, the relationship between miles flown and route mileage. Variations in this relationship will show the extent to which transport facili-





(Above) **PASSENGER TRAFFIC: Each figure = 20,000 passengers carried.**
(Right) **FREIGHT: Each box represents 1,000 tons carried.**

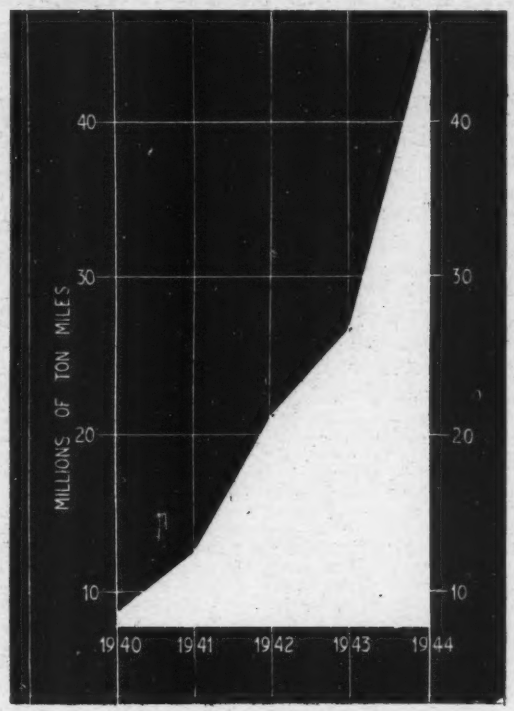
B.O.A.C. WARTIME SERVICES

ties provided along the routes have altered—increased or decreased, as the case may be.

The factor of operational intensity (miles flown/route mileage) was 196.1 in 1942, 232.8 in 1943 and 342 in 1944. Between 1942 and 1943 this increase corresponds to the increased route mileage, and if plotted on a curve would run almost parallel to it. The 1944 factor, however, higher than that in the preceding year, rises steeper than the curve of route mileage, thus approximately illustrating the increased frequency of service on the routes.

The traffic intensity factor indicating the relationship between freight actually carried and miles flown (ton-miles/miles flown) is remarkably constant, being about 1.7 for each of the three years, 1942, 1943 and 1944. Viewed against the background of operational intensity, this would indicate that the degree of utilisation of services provided remained almost the same throughout those years, despite increased frequency of operations.

In sheer traffic volume figures, these results are no doubt impressive. But it would be wrong to conjecture from them a picture of an air transport enterprise which would stand up to the merciless examination customary with commercial enterprises. Costs of operation and intensity of traffic on separate services and routes are the "to be or not to be" in competitive enterprise. Without analysing them it is impossible to gauge the economic efficiency and the *raison d'être* of an airline.



THE UPWARD TREND: The graph shows the volume of capacity ton-miles flown by the B.O.A.C.

A Wartime Enterprise

The important fact that the B.O.A.C. is not a commercial enterprise should not be overlooked, however. Standards compared with normal air transport services are indeed not applicable to the B.O.A.C. Neither its achievement nor deficiencies can be gauged by commercial standards.

Were it possible to compare results of the pre-war period with those reflecting wartime facts, one might have arrived at some interesting conclusions. But the B.O.A.C. is a wartime baby, almost born into an abnormal world, raised under emergency conditions and fed on an emergency diet of converted aircraft and "left-overs." Irrespective of what one might think of chosen instruments, it would be unreasonable to try to evaluate B.O.A.C. efforts by purely economic standards.

The B.O.A.C. as operated during the war is entirely a Government affair: except for the internal organisational and technical sides, the Secretary of State determines which routes are to be operated and who is to travel or what is to be transported.

In view of the impending changes in the constitution of British aviation, the B.O.A.C. is also likely to be subjected to major readjustments. One might therefore recall that the financial basis of the Corporation was set up by the British Overseas Airways Act, 1939, providing for a yearly subsidy up to £4,000,000 for 15 years if the Corporation expenditure exceeds its revenues.

The B.O.A.C. receives for the duration, free of charge from the Government, supplies, equipment, etc., against which all its resources are at the Government's disposal and all services rendered free of charge. The Corporation's accounts for the year ending March 31st, 1944, submitted to the House of Commons reveal that if these services were deducted at current rates for passenger, freight and mail carriage from the total Government expenditure on the Corporation, the net debit balance would be only £600,000.

The taxpayer might still be interested to know how much the job does cost him since the Government's free supplies, offset against services rendered, are also paid for with his money. He might as well ask how much he invested in each bomb dropped on Germany. It is, of course, unreasonable to measure war services in terms of £ s. d. What he might justifiably enquire is whether the cost of operating emergency air transport could not have been lower had it been based on a different footing. He might (if he is very inquisitive) even try to compare the cost of similar civilian war-conscripted air transport enterprises working for our Ally across the ocean. But this is left to the post-war research worker.

GERMAN AIRLINES

LORD SWINTON said in an interview at Capetown that "Germany would not be allowed after this war to make, own or operate aircraft. She has proved she cannot be trusted with them."

"An international organisation will have to be formed to operate her internal civilian air services," he added.

EXPANSION

THE U.S. has concluded an agreement with Spain under which it will build near Madrid an airfield to be used by aircraft supplying liberated European cities.

The airfield will be built at Barajas, near Madrid. After the war it will be converted into a general traffic field, to work in conjunction with the present Barajas airfield.

U.S. SHIPOWNERS' VIEWS

THE British White Paper on post-war aviation policy has posed "a serious problem for the American Government and the American merchant marine," said a statement issued by the National Federation of American Shipping.

Mr. Almon E. Roth, president of the Federation, said it would be to the best interests of the U.S. to permit American steamship lines to engage in air transport. "It is especially noteworthy that the British Government, after experimenting with a single air monopoly, is now firmly convinced that it is not only advisable but necessary that the steamship companies be permitted to engage in air transport," he said.

A different view was expressed by Mr. H. Q. Brown, of the International Association of Machinists, who expressed his Union's support for a unified American airline to operate abroad.

CIVIL AVIATION

The Cape Town Conference

AGREEMENTS AND PLANS : SUCCESSFUL CONCLUSION

AT its closing sessions the Cape Town Conference unanimously adopted a resolution recognising that participation in regional services by foreign Governments was desirable. It recommended that the planning of the regional services should afford scope for "co-operation by foreign Governments within the general operational scheme, or on the basis of bilateral agreements confined to particular routes and services."

The conference agreed that the development in Africa of civil aviation should be commensurate with the requirements of the areas and populations concerned and should be in harmony with any general security plan.

The conference also approved the establishment of a Southern African Air Transport Council and its co-operation with the Commonwealth Air Transport Council. The Southern Africa organisation, a resolution says, shall also co-operate with the Commonwealth Air Transport Council in formulating proposals to be submitted by an appropriate authority to an interim council with the object of promoting a multilateral agreement on air transport questions left undecided by the Chicago Conference.

The functions of the new council will be to keep under review and promote the progress and development of civil air communications in Southern Africa and serve as a medium for the exchange of views and information. It is to consider and advise on such civil air matters as any member government may desire to refer to the council, to furnish a link with the Commonwealth Air Transport Council and to keep the council fully informed of its deliberations. Meetings of the Southern Africa Air Transport Council will take place in the various countries of Southern Africa as convenient and appropriate.

The conference expressed satisfaction with the arrangements for the inauguration of a trunk service between the U.K. and South Africa under which the B.O.A.C. and South African Airways would operate reciprocal services on an agreed partnership basis.

An African Network

It has been decided that, until Salisbury airport is ready, aircraft will fly non-stop from Nairobi to Johannesburg, picking up freight, passengers and mail at Nairobi for intermediate stops. This is only an interim arrangement, as it is stressed that such a long hop is uneconomical in view of the reduction in payload owing to the increased petrol load required.

Southern Rhodesia will play a great part in regional services, providing, with South Africa, three services weekly between Johannesburg, Salisbury and Nairobi. In addition, Southern Rhodesia will provide regional and domestic services for Nothern Rhodesia and Nyasaland, and it is hoped to be able to help Kenya out in the interim period with domestic and regional services. The question of the India-Nairobi service via Aden would not arise until traffic justified it or until Indian operators expressed a desire to run a service into Nairobi.

Not only will entirely British aircraft be used on the trunk service but, by accepting the axiom that regional services should be run mainly with similar types, the conference has made it extremely likely that British aircraft will be used on regional services also. In the beginning, however, South Africa will probably utilise some of the American aircraft at present employed on some of their shuttle services, for regional purposes. Rhodesia, which will work in the closest co-operation, is using only British types at present.

The trunk air route between London and Johannesburg is to be studded with "radio lighthouses" to give aircraft their position at any given time. In addition, all the latest meteorological and radar devices developed during the war will be available on the route when the London-South Africa service commences in July, according to Dr. P. F. Schouland, chief scientific adviser to Field-Marshal Smuts at the Southern Africa Air Transport Council.

A committee has been set up to see whether meteorological radar and other scientific facilities now available on trunk and regional routes will be adequate for civil aviation and to suggest improvements. It also recommended to the new Council the creation of a research committee in South Africa. This committee would look after all research south of Nairobi. It was also recommended that the council should appoint a standing committee of specialists on radio and radar as well as a special committee on meteorology.

Air Mail

The Conference's Air Mail Committee recommended that the existing financial contribution, payable by participating countries in the terms of the Empire Air Mail Scheme, should be pooled. The position should be reviewed at the end of twelve months.

After deductions of amounts payable to certain local operators for carriage of air mails within the scheme, the balance of pooled revenue should be divided between the two trunk route operators, South Africa and the United Kingdom. South Africa's contribution would be as before, £98,000.

The Union would try, as the new trunk service became more frequent, to reduce the rates substantially, but the old all-up rate of 1½d. a half oz. is likely to disappear and a surcharge probably would always be necessary.

The present B.O.A.C. flying-boat service would continue to be used for the conveyance of troops and civilian mail until the land service was again frequent enough to carry the whole load.

The Cape Town Conference has been a remarkable achievement. As Lord Swinton said: It had achieved in five days what might never have been achieved by correspondence only.

Expressed broadly, the achievement of the conference has been to set up a British civil aviation network in Southern Africa and at the same time to provide machinery for a bilateral agreement or working arrangements with foreign powers in this area.

AMERICAN DISCUSSION

A HEAD-ON attack on the American policy at the Chicago Conference was made by Senator Brewster in a testimony before the Senate Commerce Sub-Committee which is considering a bill for the establishment of a single company to operate all American international services.

Declaring that that policy released a trade war in the air against Britain and Russia, Senator Brewster said that Britain had already retaliated with the White Paper. The commitments to freedom in the air, he added, may lead to catastrophic consequences.

Senator McCarran agreed to this interpretation of the Chicago convention or of the happenings at Chicago and pleading for support for his bill he said that the United States have to set up the most powerful agency to meet competition from Britain and Russia.

Senator McCarran's bill submitted to the sub-committee provides for the setting up of a 200,000,000 dollars American Flag Line as the chosen instrument in international operation by United States Airlines. American internal airlines may subscribe up to $50,000,000 in a class of non-speculative stock in the proposed company. Pan American Airways would hold 25 per cent. of the class "A" voting stock. It was pointed out by Senator Bailey that Pan American Airways would have control of the single-line company and that the bill would not stand the test in Congress since it would up-root the President's power to decide where America's foreign air routes should go.

MINISTERIAL FORECAST

LORD SWINTON announced that the first regular meeting of the Commonwealth Air Transport Council, formed in Montreal, would be held in London, and he expected it would be on ministerial level and that South Africa would send delegates.

There would be no International Conference as far as he could see to discuss Europe's civil air services after the war. The failure to secure a multilateral agreement at Chicago ruled this out.

Europe's post-war civil air services, other than domestic, would have to be settled by bilateral and trilateral agreements. There would probably be a need for regional conferences in Europe on the lines of that just concluded at Capetown.

CORRESPONDENCE

The Editor does not hold himself responsible for the views expressed by correspondents. The names and addresses of the writers, not necessarily for publication, must in all cases accompany letters.

PILOTS' LICENCES

More Detailed Qualifications

SOMETHING in civil aviation which requires considerable revision is the existing regulations governing the "A" and "B" pilot's licence.

It is surely inadequate to have only one licence which covers the piloting of a 100-ton aircraft and is also necessary for piloting a 40 h.p. "puddle-jumper" for commercial purposes.

Both from the technical and medical standpoint it is obvious that more detailed qualifications are necessary.

America is already at work on the regulations governing pilots' licences, so it is to be hoped that we will not fall behind in this matter, which will have much effect on civil aviation in general.

DOUGLAS DEANS.

NOT ECONOMIC

Crews of Small Civil Aircraft

THE picture published in last week's issue of *Flight* showing a model of the Miles M.60 calls attention to a fact which is likely to prove important on post-war air routes where small aircraft are used. The inscription states that the number of passengers will be 14, with a crew of two.

I believe there was some international regulation before the war about a second pilot being carried. If this is to be reinstated after the war, it will impose a considerable financial strain on the operator. The salaries of two pilots will amount to a significant proportion of the operating costs. One wonders whether two pilots are really necessary for small machines. It used to be held that the pilot might get a fly in his eye just at the moment he was about to touch down and that this might lead to an accident. It would be interesting to see readers' views on this subject.

"GEORGE."

R.Ae.S. DEBATE

Trained Engineers See Both Sides

I WAS rather surprised to see the chiding remarks about timidity of opinion at the beginning of the report on the recent R.Ae.S. debate on speed versus comfort (*Flight*, March 22nd, page 319).

Surely the reason for this is obvious. Engineers are trained always to see both sides of a question, the very basis of design being to take all the facts, pro and con, into consideration, and then to make the best compromise possible. Personally, I would be inclined to say that a man who was inclined to take a very strong view on such a problem as speed v. comfort, where there are so many desirable factors on both sides, would not be a good engineer. (That does not apply to Mr. Rumbold: he's a special case!)

I think this is also the reason why there is so little strong political feeling among designers and technicians as a whole: simply because they can see the good and bad on both sides.

S. H. W. PRINCE.

POST-WAR PRIVATE AIRCRAFT

What Features Will They Provide?

I AM constrained to wonder whether or not the small private aircraft for the delectation of the post-war owner will be fitted with a retractable undercart.

Prime reason for having a landing gear that can be tucked up is, of course, reduction in drag, and with engines of very modest horse-power this is a factor which would appear very well worth while. Conversely, retraction means added weight, added complication and maintenance, more meat in the undercarriage and adjacent structure, and, probably least convenient of all, less room.

I imagine that the only means of retraction really worthy of consideration are hydraulic or electric, principally because the average pilot does not want to be bothered with winding up his u/c legs mechanically. The same can be said for pumping the hydraulic mechanism by hand. This, then, implies a power system with concurrent disadvantages which may or may not outweigh the advantage given by reduced drag.

Personally, I am not particularly fussy about having retractable wheels. Providing the u/c legs and wheels are not too bulky and are reasonably faired, I think that is as far as one can reasonably expect to go.

I should, however, like to read any other readers' views on the subject, or even on post-war private types generally, for I imagine that the greater consensus of interested opinion which can be given to the manufactures the better.

B. H. SWINHOPE.

BOOK REVIEWS

"Aircraft Engines of the World, 1944." By Paul H. Wilkinson.

A COMPLETE record of 130 of the latest aircraft engines, including ten of the auxiliary engines now being considered for large aircraft is embodied in this new volume published in America. The data accompanying the 142 illustrations is standardised and conveniently set out for ease of reference. British, American, French, U.S.S.R., German, Italian and Japanese engines are included with a note of their main characteristics. Paul Wilkinson spent a number of years in this country with A. V. Roe, Ltd., and the Royal Aircraft Establishment before returning to America. He has travelled extensively, engines being his especial study. As a work of reference "Aircraft Engines of the World" should be in every technical library. The price is 45s., and in England it is distributed by Sir Isaac Pitman and Sons, Ltd., 39, Parker Street, E.C.2.

Aircraft Servicing Manual. By C. F. Preston and G. W. Williamson. Paul Elek, Ltd. 10s. 6d.

THIS book is a valuable contribution to the available means by which a student can familiarise himself with the standard and extent of knowledge required to obtain any or all of the ground engineers' licences.

The preliminary dissertation on the scope of duties collectively embraced in the term "aircraft engineering and maintenance" is very well done indeed. This is not to imply that the remainder of the book is of a lower standard—it most certainly is not. In point of fact this book provides probably the best synoptic survey of the ground engineers' duties that has yet been produced.

Weather Around the World. By Ivan Ray Tannehill. Princeton University Press (Sir Humphrey Milford). 16s. 6d.

THE author of this book is singularly qualified to write on meteorological subjects, for he was formerly chief of the Marine Division of the U.S. Weather Bureau and is at present chief of the very important (militarily) Division of Synoptic Reports and Forecasts. Additionally, his former book *Hurricanes: Their Nature and History*, is in its fourth edition.

Certainly it is difficult to imagine any other single work—even of three times the size—which manages to include such a wealth of weather data between its covers. What is more, this book is not to be looked upon as a technical treatise. It is written in the most simple terms and is specifically intended for the layman.

A further point which enhances its value is that weather at land and sea is described for 185 key places round the world and thus will interest flying people, soldiers, yachtsmen, farmers—in fact, almost all "open-air life" people. Incidentally, the photographs which illustrate this book are surely among the finest examples of skyscapes ever recorded by the camera.

VETERANS: Some of the Fairey Swordfish which have been operating from the Continent against German E-boats. The contents of the bulge under the fuselage have not yet been disclosed.

SERVICE AVIATION

Royal Air Force and Fleet Air Arm News and Announcements

Promotions

Air Comdre. (temp.) (Act. Air Vice-Marshal) J. A. GRAY, C.B.E., D.F.C., G.M., is granted the rank of Air Comdre. (War Subs.), February 1st, 1945.

GENERAL DUTIES BRANCH

Air Comdres. granted the acting rank of Air Vice-Marshal:

G. H. MILLS, D.F.C., Feb. 13th, 1945.
A. S. G. LEE, M.C., Feb. 19th, 1945.

Awards

Fleet Air Arm

THE KING has been graciously pleased to approve the following awards:—

For gallant service, endurance and devotion to duty while operating from or serving in H.M. ships *Campania*, *Nairana* and *Bamborough Castle* in Arctic seas while escorting convoys to and from North Russia.

Distinguished Service Cross

Temp. Lt. (A) A. R. BURGHAM, R.N.Z.N.V.R.
Temp. Sub. Lt. (A) A. I. FARNINGHAM, R.N.V.R.
Temp. Sub. Lt. (A) M. W. HENLEY, R.N.V.R.
Temp. Sub. Lt. (A) W. J. L. HUTCHISON, R.N.V.R.

Royal Air Force

THE KING has been graciously pleased to approve the following awards in recognition of gallantry and devotion to duty in the execution of air operations:—

Bar to Distinguished Service Order

Act. Group Capt. P. H. CRIBB, D.S.O., D.F.C., R.A.F., No. 582 Sqn.—This officer has commanded his squadron for a considerable period with distinction and gallantry, and has also proved himself to be an outstanding captain of aircraft. Since the award of the D.S.O. he has set a notable example to those under his command and has raised the squadron to a high pitch of efficiency. Group Capt. Cribb has recently operated over many of the most heavily defended targets in Germany, fulfilling a responsile rôle with courage and determination.

Act. Group Capt. G. F. GRANT, D.S.O., D.F.C., R.A.F., No. 109 Sqn.—Group Capt. Grant has been in command of his squadron since May, 1944. He has displayed great powers of leadership and has been largely responsible for the successful operations completed by his squadron. During his long operational career, this officer has displayed the greatest enthusiasm and determination, and by his untiring efforts and splendid example the squadron has attained a high standard of skill and accuracy.

Distinguished Service Order

Wing Cdr. J. H. GILES, D.F.C., R.A.F.O., No. 186 Sqn.—Since the award of the D.F.C., this officer has led his squadron on many daylight operations with courage and skill. He is an excellent squadron commander, who, by his untiring efforts and unswerving devotion to duty, both in the air and on the ground, has set an inspiring example to all, and has materially contributed to the high standard of operational efficiency attained by the squadron.

Wing Cdr. L. D. WILSON, D.F.C., A.F.C., R.A.F., No. 102 Sqn.—Wing Cdr. Wilson has taken part in numerous operational sorties since the award of the D.F.C. He has also proved to be a squadron commander of outstanding quality, possessing a high order of courage and devotion to duty. On four recent occasions his aircraft has been damaged by anti-aircraft fire. While leading a mission to Scholven in October, 1944, damage was sustained in the wings and fuselage on the bombing run. In spite of this, Wing Cdr. Wilson continued to fly straight and level over the target. On all his sorties this officer has set a fine example of courage, determination and efficiency.

Act. Wing Cdr. A. H. C. BOXER, D.F.C., R.A.F.O., No. 161 Sqn.—Wing Cdr. Boxer has commanded his squadron with great ability for a long period. He has been very keen to fly on all types of operations, irrespective of the hazards involved. By his skill and determination he has set a fine example to all in his squadron.

Act. Wing Cdr. W. J. BURNETT, D.F.C., R.A.F.O., No. 138 Sqn.—This officer has commanded his squadron with outstanding success for a considerable period. During this time the squadron has been engaged in intensive operations. In addition to proving himself an efficient and capable commander, Wing Cdr. Burnett has, at all times, displayed keenness to fly on operations, irrespective of the hazards involved. On several occasions he has had combats with enemy fighters. His courage and determination have always been an inspiration to those under his command.

Act. Wing Cdr. R. C. COBBE, R.A.F., No. 109 Sqn.—Wing Cdr. Cobbe has completed a long and distinguished tour of operations, during which he has attacked most of the major German targets. As a flight commander and captain of aircraft he has always displayed the utmost thoroughness and efficiency. He is always ready to participate in the most hazardous and arduous flights and, by his courage and leadership, has set a fine example to the squadron.

Act. Wing Cdr. T. G. JEFFERSON, A.F.C., R.A.F.V.R., No. 105 Sqn.—Wing Cdr. Jefferson has served in both the Middle East and European theatres of war. He is a most skilful pilot and an excellent flight commander who always presses home his attacks with the greatest determination, often in the face of intense enemy opposition and adverse weather.

Act. Wing Cdr. J. NORTHROP, R.A.F., No. 692 Sqn.—This officer is an outstanding squadron commander and captain of aircraft. He has had a

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long and successful career of operational flying and his devotion to duty and enthusiasm are reflected in the high standard of efficiency attained by the squadron under his command. He has led many sorties, at all times inspiring his crews by his courage and determination to reach and bomb his objective regardless of opposition. He has made many attacks on Berlin.

Sqn. Ldr. J. H. LAUGHLIN, M.B.E., R.A.F.O., No. 149 Sqn.—This officer has participated in a large number of operational sorties. During his first tour of duty he destroyed at least three enemy aircraft. On his second tour Sqn. Ldr. Laughlin has completed numerous mine-laying operations and day and night bombing sorties. He has taken part in attacks on such heavily defended targets as Duisburg, Oberhausen and Cologne, pressing home these attacks despite intense anti-aircraft fire, which, on several occasions, has damaged his aircraft. As a flight commander this officer has always set an inspiring example by his outstanding enthusiasm and devotion to duty.

Act. Sqn. Ldr. N. BOWMAN, D.F.C., R.A.F.V.R., No. 109 Sqn.—Now on his third tour of operational duty, this officer has taken part in a large number of sorties. Since the award of the D.F.C. he has attacked many of the enemy's most heavily defended targets in Germany. As squadron navigation officer, both in the air and on the ground, his enthusiasm, skill, sound technical knowledge and organising ability have been of the greatest value to his squadron. His work has been of an important and extensive character, and he has shown great determination to achieve success, whatever the odds.

Act. Sqn. Ldr. N. S. MINGARD, D.F.C., R.A.F.V.R., No. 582 Sqn.—Sqn. Ldr. Mingard has a splendid record of operations as captain of an outstanding crew. On a large number of occasions he has participated in attacks on major targets in the Ruhr where the heaviest defences have been encountered. Throughout his tour of duty this officer has displayed exceptional qualities of gallantry and leadership.

Act. Sqn. Ldr. R. G. WILLIAMS, D.F.C., R.A.F.V.R., No. 7 Sqn.—Throughout his numerous operations, Sqn. Ldr. Williams has displayed undaunted courage and his strong sense of duty and outstanding skill have, on more than one occasion, saved his crew in difficult and hazardous situations. His devotion to duty, cheerfulness and determination to press home every mission to the utmost have set a high example to all in the squadron. He is nearing the completion of a double tour.

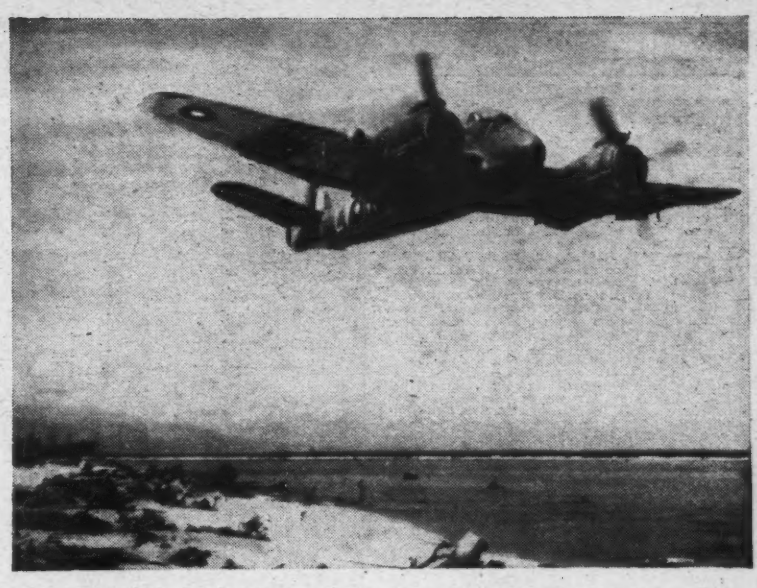
Flt. Lt. J. M. W. BRIGGS, D.F.C., D.F.M., R.A.F.—Since the award of the D.F.C. this officer has continued to perform his duties in a most efficient and praiseworthy manner. By his outstanding courage and keenness he has set a very high standard. On a large number of varied sorties he has never allowed the heaviest enemy opposition or adverse weather to deter him from completing his allotted tasks and, in consequence of his undaunted courage and determination he has invariably obtained excellent results. Flt. Lt. Briggs' reliability and devotion to duty have been of the utmost value to his unit.

Flt. Lt. B. A. BUCKHAM, D.F.C., R.A.A.F., No. 463 (R.A.A.F.) Sqn.—Since the award of the D.F.C., Flt. Lt. Buckham has participated in many photographic sorties and has continued to display a high standard of operational efficiency. His work has involved remaining in the target area throughout the attack in order to secure photographs. He has taken part in all three attacks on the battleship *Tirpitz*, on each occasion descending far below normal altitude to obtain excellent photographs. He is an outstandingly capable captain of aircraft, resourceful and courageous to a very high degree.

Flt. Lt. C. W. J. FALKINDER, D.F.C., R.A.A.F., No. 109 Sqn.—This officer has displayed consistent skill and courage on a large number of difficult and dangerous operations. As a navigator, his determination and efficiency have been responsible for the success of many major attacks. His outstanding ability and fine fighting spirit have been a valuable asset to his squadron.

Act. Flt. Lt. E. W. SMITH, R.C.A.F., No. 424 (R.C.A.F.) Sqn.—This officer has completed two tours of operational duty. He has attacked some of the enemy's most important and heavily defended targets. On one occasion his aircraft was shot down by enemy action, and another time he was forced down on to the sea. Flt. Lt. Smith has consistently flown in adverse weather and in the face of intense enemy opposition, but he has never let that deter him from completing his missions. Throughout his operational career this officer has displayed the highest standard of courage, determination and devotion to duty.

Act. Sqn. Ldr. A. P. GAINSFORD, D.F.C., A.F.C., R.N.Z.A.F., No. 150 Sqn.—Since the award of the D.F.C. this officer has flown on a large number of successful sorties over heavily defended centres in Germany and occupied territory. These have included missions to Essen, Kiel and Cologne, where heavy anti-aircraft and fighter opposition has invariably been encountered. Sqn. Ldr. Gainsford has always completed these attacks with great skill and efficiency, and has set an outstanding example of skilful leadership.



JAP STRAFER: A R.A.A.F. Beaufighter sets out from its landing strip for a sortie, carrying eight rocket-projectiles.

Flt. Lt. T. W. ALLEN, D.F.C., R.N.Z.A.F., No. 192 Sqn.—Flt. Lt. Allen is now on his third tour of operational duty. Since being awarded the D.F.C. he has taken part in many more sorties and has never once failed to complete his mission. His sorties have included day and night attacks against heavily defended targets in Germany, Italy and the Middle East. This officer is an outstanding pilot and flight commander, and has accomplished all his duties with efficiency and courage.

Bar to Distinguished Flying Cross

Act. Sqn. Ldr. A. R. SCOTT, D.F.C., R.N.Z.A.F., No. 90 Sqn.—Since the award of the D.F.C., Sqn. Ldr. Scott has continued to operate with outstanding success. His undaunted courage in pressing home his attacks in the face of heavy opposition, together with his excellent leadership, determination, and consistent devotion to duty, have won the confidence and admiration of all his crew.

Act. Sqn. Ldr. J. M. SMITH, D.F.C., R.N.Z.A.F., No. 97 Sqn.—Since the award of the D.F.C., Sqn. Ldr. Smith has continued to operate with commendable skill and courage. His aircraft has been in combat with enemy fighters, but, despite this, Sqn. Ldr. Smith has always pressed home his attacks to a successful conclusion. His great determination and high standard of devotion to duty have set an excellent example to all.

F/O. J. F. THOMSON, D.F.C., R.N.Z.A.F., No. 627 Sqn.—This officer has a long and distinguished record of operational flying. He is now on his third tour of duty, and since the award of the D.F.C. he has participated in attacks against heavily defended objectives in Germany, such as Berlin, Cologne and Kiel. F/O. Thomson has throughout shown great gallantry and determination.

The badge of No. 450 (R. A. A. F.) Sqn.—"Harass."

F/O. L. B. WINSLOE, D.F.C., R.N.Z.A.F., No. 105 Sqn.—Since the award of the D.F.C., F/O. Winsloe has participated in many further sorties on his second tour of duty. He has at all times maintained an excellent standard of navigational skill and determination, which, combined with his unfailing courage and devotion to duty, merit high commendation.

Act. Flt. Lt. A. B. BOYLE, D.F.C., R.A.A.F., No. 467 (R.A.A.F.) Sqn.—Flt. Lt. Boyle has completed two tours of operations, which have included attacks against such heavily defended targets as Kiel, Stuttgart and Konigsberg. By his fine leadership, courage and determination he has won the confidence and admiration of his crew. In August, 1944, his aircraft was detailed to attack Stettin. Owing to bad visibility over the target area Flt. Lt. Boyle descended below cloud level and pressed home his attack from a low level. His initiative, enthusiasm and devotion to duty have always been most commendable.

Act. Flt. Lt. A. McK. MCDONALD, D.F.C., D.F.M., R.A.A.F., No. 571 Sqn.—Since the award of the D.F.C., Flt. Lt. McDonald has participated in numerous attacks against heavily defended targets in Germany. He has also taken part in a mine-laying operation in the Dortmund-Ems Canal. Flt. Lt. McDonald has consistently displayed great skill and the utmost keenness for operational flying.

Act. Flt. Lt. J. C. ORAM, D.F.C., R.A.A.F., No. 626 Sqn.—Since the award of the D.F.C., this officer has taken part in attacks against such strongly defended targets as Stuttgart, Stettin, Kiel and Essen. As captain of aircraft he has consistently displayed a fine fighting spirit, while his calm courage in the face of the enemy has inspired confidence in his crew. In October, 1944, when his aircraft was attacked by two Messerschmitts 109's, as a result of Flt. Lt. Oram's fine airmanship one enemy aircraft was destroyed.

Act. Flt. Lt. G. F. NICHOLL, D.F.C., R.C.A.F., No. 405 (R.C.A.F.) Sqn.—Flt. Lt. Nicholl has proved himself to be a most successful and efficient bomb aimer who has now completed two tours of operations. Since the award of the D.F.C. he has participated in further attacks against important German targets. He has continued to operate with the utmost determination, courage and devotion to duty.

Act. Flt. Lt. W. RODNEY, D.F.C., R.C.A.F., No. 78 Sqn.—Since the award of the D.F.C. this officer has flown on many more operational sorties. He has continued to display outstanding keenness, courage and initiative, and, as captain of aircraft and deputy flight commander, he has set an inspiring example to all.

Act. Flt. Lt. R. J. BAYNE, D.F.C., R.C.A.F., No. 405 (R.C.A.F.) Sqn.—Since the award of the D.F.C., Flt. Lt. Bayne has continued to perform his missions in a most praiseworthy manner. He is an extremely efficient member of a most reliable crew. His skill, courage and devotion to duty have been an incentive to his fellow crew members.

Act. Flt. Lt. M. B. CARDNO, D.F.C., R.C.A.F., No. 405 (R.C.A.F.) Sqn.—Throughout a long and eventful operational career this officer has always displayed the utmost determination to complete his missions. He has completed two tours of operations and has participated in many attacks on such heavily defended areas as Berlin, Stuttgart and Hanover. His outstanding skill, courage and unfailing devotion to duty have been most praiseworthy.

Act. Flt. Lt. J. E. FRANEY, D.F.C., R.A.F.V.R., No. 105 Sqn.—Since the award of the D.F.C., Flt. Lt. Franey has participated in numerous sorties. Throughout he has maintained a notable standard of reliability and skill which has largely contributed to the successes achieved by his crew. His courage, fortitude and devotion to duty have always been of the highest order.

Act. Flt. Lt. G. F. W. GILLESPIE, D.F.C., R.A.F.V.R., No. 405 (R.C.A.F.) Sqn.—Throughout two tours of operations Flt. Lt. Gillespie has displayed outstanding navigational skill and devotion to duty. He has participated in numerous attacks against such vital targets as Berlin, Stuttgart and Frankfurt. Since the award of the D.F.C. he has maintained a high standard of cool courage and determination.

Act. Flt. Lt. L. D. GROOME, D.F.C., R.A.F.V.R., No. 139 Sqn.—Since the award of the D.F.C., Flt. Lt. Groome has completed many further missions, including 14 against Berlin. On two occasions his aircraft has sustained severe damage from enemy action. Despite this he has continued to show undiminished enthusiasm for operations. His outstanding skill, determination

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and unfailing devotion to duty have set a splendid example to all members of his squadron.

Act. Flt. Lt. W. F. HOWARD, D.F.C., R.A.F.V., No. 405 (R.C.A.F.) Sqn.—Since the award of the D.F.C. Flt. Lt. Howard has continued to operate with outstanding skill and determination. He has now completed two tours of operations and has participated in attacks against such heavily defended targets as Berlin, Stuttgart and Frankfurt. His brilliant navigation has materially contributed to the successful completion of many important missions.

Act. Flt. Lt. G. W. JOHNSON, D.F.C., R.A.F.V.R., No. 635 Sqn.—Since the award of the D.F.C. Flt. Lt. Johnson has completed many further sorties. As pilot and captain of aircraft he has continued to maintain a high standard of courage, determination and devotion to duty. He has often been called upon to play a most important rôle and he has accomplished all his tasks, however, arduous, with efficiency, cheerfulness and cool confidence.

Act. Flt. Lt. V. F. R. KENWARD, D.F.C., R.A.F.V.R., No. 582 Sqn.—Since the award of the D.F.C. this officer has completed many sorties which have demanded a high degree of skill and resolution. He has at all times shown himself to be a keen and courageous air bomber, while his unfailing devotion to duty has been most praiseworthy.

Act. Flt. Lt. C. H. MATTHEWMAN, D.F.C., R.A.F.V.R., No. 109 Sqn.—Since the award of the D.F.C. this officer has completed many operational sorties against heavily defended targets. These have demanded great skill and resolution and he has at all times displayed great keenness for operational flying, high courage and consistent devotion to duty.

Act. Flt. Lt. V. W. G. MUSGROVE, D.F.C., R.A.F.V.R., No. 105 Sqn.—Since the award of the D.F.C., Flt. Lt. Musgrove has completed many further missions. Throughout all his operations he has shown great navigational skill, high courage often in the most arduous and difficult circumstances and consistent devotion to duty.

Act. Flt. Lt. D. J. STREET, D.F.C., R.A.F., No. 582 Sqn.—Since the award of the D.F.C. this officer has continued to operate with great courage and devotion to duty. Despite many adverse circumstances he has always shown outstanding leadership and determination which have materially contributed to many successes.

Act. Flt. Lt. R. L. VINES, D.F.C., R.A.F.V.R., No. 635 Sqn.—Since the award of the D.F.C., Flt. Lt. Vines has completed a second tour of operational duty. As captain of his aircraft, he has frequently been detailed to play a most responsible rôle, in operations against such heavily defended targets as Essen, Stuttgart and Berlin and has always pressed home his attacks with the utmost determination. Flt. Lt. Vines' courage, coolness and skill in action have been an inspiring example to his crew.

F/O. J. E. BAKER, D.F.C., R.A.F.V.R.—This officer has a long and distinguished record as a navigator. He has successfully participated in numerous operational sorties against a wide range of targets. Since the award of the D.F.C. F/O. Baker has continued to display exceptional courage, outstanding skill and unfailing devotion to duty which have been worthy of high commendation.

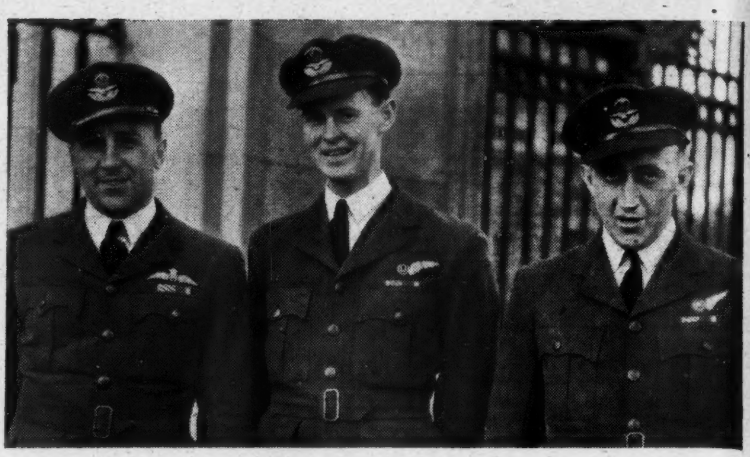
Act. Flt. Lt. J. P. H. CARRERE, D.F.C., R.C.A.F., No. 105 Sqn.—Since the award of the D.F.C., Flt. Lt. Carrere has participated in a large number of operational sorties. Throughout, he has shown himself a highly skilled and most reliable navigator. His cool courage, tenacity of purpose and concentration on the task in hand in the most arduous circumstances have been most commendable.

Act. Flt. Lt. D. P. DAVIES, D.F.C., R.C.A.F., No. 405 (R.C.A.F.) Sqn.—Since the award of the D.F.C., Flt. Lt. Davies has continued to operate with exceptional keenness and efficiency, participating in attacks against such strongly defended targets as Duisburg, Cologne and Stuttgart. He has shown fine leadership, both in the air and on the ground, and has taken a keen interest in the training of less experienced navigators. Flt. Lt. Davies's unselfish devotion to duty and fine fighting spirit have set an inspiring example to all.

Act. Flt. Lt. F. A. EBDON, D.F.C., R.C.A.F., No. 405 (R.C.A.F.) Sqn.—Since the award of the D.F.C., Flt. Lt. Ebdon has continued to operate with the utmost keenness and efficiency, participating in attacks against such heavily defended targets as Frankfurt, Essen and Stettin. This officer's fine courage and devotion to duty have contributed largely to the many successes attained by his crew.

Act. Flt. Lt. R. W. HISCOTT, D.F.C., R.C.A.F., No. 405 (R.C.A.F.) Sqn.—Since the award of the D.F.C., Flt. Lt. Hiscott has participated in further sorties against such heavily defended targets as Wilhelmshaven, Stuttgart, Karlsruhe and Duisburg. He has invariably displayed keenness and a high sense of responsibility. His fearlessness and devotion to duty have had a most inspiring effect on all members of his squadron.

Act. Flt. Lt. C. C. MAGEE, D.F.C., R.C.A.F., No. 582 Sqn.—This officer has completed a large number of day and night missions during which he has successfully attacked a wide range of strongly defended targets. He has maintained an excellent standard of operational efficiency and has at all times shown courage and devotion to duty of a high order.



Three Australian airmen, members of the same Halifax crew, who each received the D.F.C. at a recent investiture. Left to right: Sqn. Ldr. Eagleton, Flt. Lt. Wade, F/O. McCosker.

Act. Wing Cdr. D. C. HAGERMAN, D.F.C., R.C.A.F., No. 419 (R.C.A.F.) Sqn.—Since the award of the D.F.C. this officer has attacked numerous important and heavily defended targets. He has been in command of his squadron since August, 1944, and has inspired all the members by his fine fighting spirit, outstanding courage and devotion to duty. On one occasion in November, 1944, when approaching the target at Munster, one engine of his aircraft failed. Without hesitation Wing Cdr. Hagerman pressed on and successfully bombed his objective. On the return flight another engine failed, but by fine airmanship this officer flew safely back to base.

Act. Sqn. Ldr. L. B. BURNAND, D.F.C., R.C.A.F., No. 405 (R.C.A.F.) Sqn.—Throughout two tours of operations Sqn. Ldr. Burnand has proved himself to be a most efficient pilot and captain of aircraft. He has completed many attacks against such heavily defended targets as Berlin, Stuttgart and Frankfurt. On many occasions he has been detailed for highly dangerous and important missions and, despite all opposition, he has always pressed home his attacks with the utmost determination. At all times he has displayed excellent leadership, unfailing devotion to duty and a fine fighting spirit which have been most praiseworthy.

Flt. Lt. H. SMITH, D.F.C., R.C.A.F., No. 405 (R.C.A.F.) Sqn.—Throughout his tours of operations Flt. Lt. Smith has proved himself to be a most efficient pilot and captain of aircraft. He has participated in attacks against such well defended targets as Stuttgart, Berlin and Kiel. His fine fighting spirit, fearless courage and devotion to duty have won the admiration of all pilots in his squadron.

Flt. Lt. G. C. TYNAN, D.F.C., R.C.A.F., No. 405 (R.C.A.F.) Sqn.—Throughout two tours of operations Flt. Lt. Tynan has proved himself to be a very keen and skilful navigator. He has participated in a large number of operational missions against such heavily defended targets as Frankfurt, Essen and Stuttgart. Since the award of the D.F.C., Flt. Lt. Tynan has continued to display high courage, devotion to duty and a fine fighting spirit which have set an inspiring example to all.

The badge of No. 570 Sqn., R.A.F. — "Impetum Deducimus" ("We Launch the Spearhead").

Act. Sqn. Ldr. D. P. D. ARCHER, D.F.C., D.F.M., R.A.F.V.R., No. 582 Sqn.—Since the award of the D.F.C. this officer has completed many sorties as a navigator. He has at all times displayed the utmost keenness, determination and devotion to duty which have set an inspiring example to all with whom he has served.

Act. Sqn. Ldr. H. J. HEAL, D.F.C., R.A.F.O., No. 635 Sqn.—This officer has completed numerous sorties and has now finished his second tour of operational duty. He has successfully participated in attacks against many heavily defended targets and he has always shown the utmost courage in the face of danger. Both in the air and on the ground, Sqn. Ldr. Heal has continued to maintain a high standard of skill, determination and devotion to duty.

Act. Sqn. Ldr. M. H. PARRY, D.F.C., A.F.C., R.A.F.V.R., No. 106 Sqn.—Since the award of the D.F.C. this officer has completed further successful missions against strongly defended enemy targets. On one occasion he pressed home a telling low-level attack on railway sidings despite appalling weather. He has been in command of a flight since October, 1944, and he has worked ceaselessly and selflessly to maintain and improve the excellent operational standard of his crews. Sqn. Ldr. Parry is an outstanding pilot and leader who by his skill and devotion to duty has set an inspiring example to all.

Flt. Lt. C. H. BROWN, D.F.C., R.A.F.V.R., No. 105 Sqn.—This officer has completed numerous operational sorties against a wide range of targets. By his skilful and accurate navigation, often in the most hazardous circumstances, he has materially contributed to the successful completion of many missions Since the award of the D.F.C., Flt. Lt. Brown has continued to display outstanding courage, determination and devotion to duty.

Flt. Lt. C. E. J. COLVIN, D.F.C., R.A.F.V.R., No. 105 Sqn.—Flt. Lt. Colvin has completed a large number of sorties since the award of the D.F.C. Throughout all his operations he has shown himself to be a skilful and reliable navigator who has played a large part in the many successes achieved by his crew. His courage and devotion to duty in adverse circumstances have been worthy of the highest praise.

Flt. Lt. L. HENSON, D.F.C., R.A.F.V.R., No. 635 Sqn.—Since the award of the D.F.C. Flt. Lt. Henson has completed his second tour of operations. He has participated in attacks against many heavily defended German targets, including Stettin and Frankfurt. Throughout he has proved himself to be an excellent pilot and, by his cheerful courage and determination, he has won the admiration and confidence of his crew.

Flt. Lt. L. de HOLLAND, D.F.C., R.A.F.V.R., No. 105 Sqn.—Since the award of the D.F.C., Flt. Lt. Holland has completed many further operational sorties, including attacks against major targets in the Ruhr valley. At all times he has shown outstanding pilotage, cool courage and unfailing devotion to duty which have been worthy of high praise.

Flt. Lt. G. B. SHARMAN, D.F.C., R.A.F.V.R., No. 433 (R.C.A.F.) Sqn.—Since the award of the D.F.C., Flt. Lt. Sharman has taken part in many operational sorties, the majority of which have been against important and heavily defended targets in Germany and France. In addition his instructional work has been of great value to his squadron. This officer has, at all times, set an inspiring example of skill and devotion to duty.

Flt. Lt. K. WOLSTENHOLME, D.F.C., R.A.F.V.R., No. 105 Sqn.—Since being awarded the D.F.C., this officer has continued to operate with noteworthy ability as a pilot, and has shown outstanding courage, judgment and tenacity of purpose. In the most adverse circumstances he has achieved results of the highest order.

Act. Flt. Lt. J. BOOTH, D.F.C., R.A.F.V.R., No. 156 Sqn.—Flt. Lt. Booth has completed a second tour of operations which have included many attacks against heavily defended targets. Since the award of the D.F.C. he has continued to display a keen zest for operational flying which together with his outstanding determination and cheerful courage have set a fine example to all.

Flt. Lt. M. WILLIAMSON, D.F.C., R.A.F.V.R., No. 109 Sqn.—Flt. Lt. Williamson has completed many sorties against heavily defended targets in Germany since the award of the D.F.C. Regardless of enemy opposition he has at all times pressed home his attacks with the greatest determination. His fine fighting spirit has inspired confidence in the members of his crews.

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F/O. E. J. RIGBY, R.A.F.V.R., No. 35 Sqn.
F/O. A. J. CARD, R.A.F.V.R., No. 35 Sqn.
Act. F/O. H. J. MUSSELMAN, R.C.A.F., No. 166 Sqn.
F/O. J. K. H. MEAD, R.A.F.V.R., No. 158 Sqn.
F/O. A. McD. MOFFAT, R.A.F.V.R., No. 158 Sqn.
F/O. J. H. PENMAN, R.A.F.V.R., No. 640 Sqn.
F/O. W. H. SPRAGG, R.A.F.V.R., No. 207 Sqn.
F/O. G. A. A. WITHERICK, D.F.M., R.A.F., No. 617 Sqn.

Act. F/O J. L. BOWMER, D.F.M., R.A.F.V.R., No. 10 Sqn.
Act. F/O. W. FRANK, R.A.F.V.R., No. 115 Sqn.
Act. F/O. J. R. POUNTNEY, R.A.F.V.R., No. 640 Sqn.
Act. F/O. D. V. TAMS, R.A.F.V.R., No. 640 Sqn.
Act. F/O. J. VASEY, R.A.F.V.R., No. 57 Sqn.
P/O. D. E. BROUGHTON, R.A.F.V.R., No. 97 Sqn.
P/O. J. S. CAMPBELL, R.A.F.V.R., No. 578 Sqn.
P/O. A. E. CLARK, R.A.F.V.R., No. 514 Sqn.
P/O. T. W. P. CLIFFORD, R.A.F., No. 101 Sqn.
P/O. F. D. COLLINS, R.A.F.V.R., No. 640 Sqn.
P/O. W. D. DAVIES, R.A.F.V.R., No. 158 Sqn.
P/O. J. R. C. DONOHUE, R.A.F.V.R., No. 158 Sqn.
P/O. G. B. DUNNING, R.A.F.V.R., No. 138 Sqn.
P/O. P. R. DUNSFORD, R.A.F.V.R., No. 102 Sqn.
P/O. S. LEONARD, R.A.F.V.R., No. 10 Sqn.
P/O. D. R. METCALF, R.A.F.V.R., No. 138 Sqn.
P/O. J. F. MUNNOCH, R.A.F.V.R., No. 640 Sqn.
P/O. L. W. RIDDLE, D.F.M., R.A.F.V.R., No. 7 Sqn.
P/O. T. A. SHEEN, R.A.F.V.R., No. 83 Sqn.
P/O. G. F. SNELL, R.A.F.V.R., No. 10 Sqn.
W/O. F. DENTON, D.F.M., R.A.F., No. 15 Sqn.
W/O. (now P/O.) J. HOBSON, R.A.F., No. 640 Sqn.
W/O. J. F. G. MANN, D.F.M., R.A.F., No. 582 Sqn.
W/O. H. W. WELHAM, R.A.F.V.R., No. 141 Sqn.
F/O. D. J. REYNOLDS, R.A.A.F., No. 467 (R.A.A.F.) Sqn.
F/O. M. F. SWEENY, R.A.A.F., No. 463 (R.A.A.F.) Sqn.
Act. F/O. S. J. LAPIDGE, R.A.A.F., No. 158 Sqn.
Act. F/O. M. J. TILLY, R.A.A.F., No. 640 Sqn.
P/O. D. L. S. GAPEL, R.A.A.F., No. 15 Sqn.
P/O. J. E. COX, R.A.A.F., No. 463 (R.A.A.F.) Sqn.
P/O. P. R. LANYON, R.A.A.F., No. 640 Sqn.
P/O. E. W. MCLACHLAN, R.A.A.F., No. 15 Sqn.
P/O. J. W. THERKELSEN, R.A.A.F., No. 158 Sqn.
F/O. L. R. LAUZON, R.C.A.F., No. 432 (R.C.A.F.) Sqn.
Act. F/O. T. D. WRAY, R.C.A.F., No. 158 Sqn.
P/O. L. P. MORGAN, R.C.A.F., No. 419 (R.C.A.F.) Sqn.
P/O. M. ROSKO, R.C.A.F., No. 578 Sqn.
P/O. J. S. SANDERSON, R.C.A.F., No. 100 Sqn.
W/O.1 C. FERRIS, R.C.A.F., No. 434 (R.C.A.F.) Sqn.
F/O. R. E. C. HOGG, R.N.Z.A.F., No. 102 Sqn.
Act. F/O. E. T. COSSENS, R.N.Z.A.F., No. 514 Sqn.
F/O. F. A. DARLINGTON, R.A.F.V.R., No. 7 Sqn.
F/O. G. V. DELAROY-HALL, R.A.F.V.R., No. 78 Sqn.
F/O. F. G. DIAMOND, R.A.F.V.R., No. 571 Sqn.
F/O. A. A. DIGGINS, R.A.F.V.R., No. 156 Sqn.
F/O. J. W. H. DOBBIE, R.A.F.V.R., No. 97 Sqn.
Flt. Lt. H. R. MOODY, R.A.F.V.R., No. 571 Sqn.
Flt. Lt. D. A. MOREY, R.A.F.V.R., No. 7 Sqn.
Flt. Lt. K. H. NEVILLE, R.A.F.V.R., No. 109 Sqn.
Flt. Lt. D. NODEN, R.A.F.V.R., No. 608 Sqn.
Flt. Lt. J. V. SAMPSON, R.A.F.V.R., No. 102 Sqn.
Flt. Lt. S. O. SEARLES, R.A.F.V.R., No. 139 Sqn.
Flt. Lt. E. G. W. SELBY, R.A.F.V.R., No. 78 Sqn.
Flt. Lt. F. A. TAYLOR, R.A.F.V.R., No. 105 Sqn.
Flt. Lt. A. J. THOMPSON, R.A.F.V.R., No. 12 Sqn.
Flt. Lt. W. J. TREHARNE, R.A.F.V.R., No. 625 Sqn.
Flt. Lt. F. S. WALDREN, R.A.F., No. 199 Sqn.
Flt. Lt. P. H. WATERKEYN, R.A.F.V.R., No. 139 Sqn.
Flt. Lt. R. L. A. WOOLGAR, R.A.F.V.R., No. 192 Sqn.
Act. Flt. Lt. T. J. BAYLISS, R.A.F.V.R., No. 214 Sqn.
Act. Flt. Lt. T. BELL, R.A.F.V.R., No. 109 Sqn.
Act. Flt. Lt. K. R. BLACKHURST, R.A.F.V.R., No. 635 Sqn.
Act. Flt. Lt. R. H. BOYERS, R.A.F.V.R., No. 51 Sqn.
Act. Flt. Lt. D. M. D BROWN, R.A.F.V.R., No. 100 Sqn.
Act. Flt. Lt. L. J. B. BUCKLEY, R.A.F.V.R., No. 105 Sqn.
Act. Flt. Lt. D. J. BUTTERS, R.A.F.V.R., No. 7 Sqn.
Act. Flt. Lt. D. M. CLARK, R.A.F.V.R., No. 550 Sqn.
Act. Flt. Lt. K. M. DAVEY, R.A.F.V.R., No. 44 Sqn.
Act. Flt. Lt. J. R. DAVIS, R.A.F.V.R., No. 109 Sqn.
Act. Flt. Lt. J. H. DEAN, R.A.F.V.R., No. 463 (R.A.A.F.) Sqn.
Act. Flt. Lt. P. C. ELLIFF, R.A.F.V.R., No. 100 Sqn.
Act. Flt. Lt. M. GARTON, R.A.F.V.R., No. 103 Sqn.
Act. Flt. Lt. I. HAMILTON, R.A.F.V.R., No. 97 Sqn.
Act. Flt. Lt. M. E. HATCH, R.A.F.V.R., No. 97 Sqn.
Act. Flt. Lt. T. KENNEDY, R.A.F.V.R., No. 156 Sqn.
Act. Flt. Lt. J. D. LANE, R.A.F.V.R., No. 78 Sqn.
Act. Flt. Lt. E. W. LEWIS, R.A.F.V.R., No. 44 Sqn.
Act. Flt. Lt. R. F. LEWIS, R.A.F.V.R., No. 105 Sqn.

The badge of No. 137 Sqn., R.A.F.—"Do Right, Fear Naught."

Bar to Distinguished Flying Medal

Flt. Sgt. A. A. BEBER, D.F.M., R.A.F.V.R., No. 571 Sqn.

Distinguished Flying Medal

Flt. Sgt. K. G. ELLIS, R.A.F.V.R., No. 540 Sqn.
Sgt. R. H. PAYNE, R.A.F.V.R., No. 227 Sqn.
Sgt. A. WILKINSON, R.A.F.V.R., No. 90 Sqn.
Flt. Sgt. J. A. PEDUZIE, R.A.F.V.R., No. 514 Sqn.
Sgt. (now P/O) R. O. HUNTER, R.C.A.F., No. 186 Sqn.
Flt. Sgt. F. D. MURPHY, R.A.A.F., No. 158 Sqn.
Flt. Sgt. P. R. PATTERSON, R.A.A.F., No. 158 Sqn.
Flt. Sgt. A. J. SMITH, R.A.A.F., No. 463 (R.A.A.F.) Sqn.
Flt. Sgt. R. F. POWELL, R.A.F.V.R., No. 97 Sqn.
Flt. Sgt. J. D. SHARP, R.A.F.V.R., No. 158 Sqn.
Flt. Sgt. L. WAYTE, R.A.F.V.R., No. 166 Sqn.
Sgt. G. A. HILLIER, R.A.F.V.R., No. 57 Sqn.
Sgt. A. J. A. YORK, R.A.F.V.R., No. 619 Sqn.
Flt. Sgt. E. C. L. COOMBS, R.A.F.V.R., No. 35 Sqn.
Sgt. R. F. COOPER, R.A.F.V.R., No. 35 Sqn.
Flt. Sgt. L. R. MASON, R.C.A.F., No. 106 Sqn.
Flt. Sgt. (now P/O.) W. MOLDEN, R.C.A.F., No. 415 (R.C.A.F.) Sqn.
Flt. Sgt. (now P/O) J. L. BARRINGTON, R.A.A.F., No. 460 (R.A.A.F.) Sqn.
Flt. Sgt. E. L. M. BEAR, R.A.A.F., No. 625 Sqn.
Flt. Sgt. A. E. BARRETT, R.A.F.V.R., No. 15 Sqn.
Flt. Sgt. A. F. BROWN, R.A.F.V.R., No. 57 Sqn.
Flt. Sgt. F. H. HESKETH, R.A.F.V.R., No. 12 Sqn.
Flt. Sgt. A. MAUNDER, R.A.F.V.R., No 83 Sqn.

THE KING has been graciously pleased to approve the following awards:—

George Cross (Posthumous)

F/O. R. B. GRAY, R.C.A.F.—One night in August, 1944, this officer was the navigator of a Wellington aircraft which was shot down into the sea by a U-boat in the Atlantic. F/O. Gray and three other members of the crew managed to extricate themselves from the aircraft. Despite a severe wound in the leg, F/O. Gray succeeded in inflating his own dinghy and then assisted his captain, who had also been wounded, into it. Shortly afterwards cries were heard from another member of the crew, who had broken his arm, and F/O. Gray also helped him into the dinghy. Knowing that it could not hold more than two persons, F/O. Gray, although suffering intense pain, refused to get into the dinghy. Assisted by another member of the crew and by an occupant of the dinghy, he held on to its side for some hours. The pain from his leg (it is thought that the lower part had been shot off) was increasing in intensity and he was becoming exhausted. He steadfastly refused, however, to endanger his comrades by entering the dinghy. He eventually lost consciousness and died. When it became light his companions realised that he was dead and they were forced to let his body sink. The survivors were rescued later. F/O. Gray displayed magnificent courage and unselfish heroism, thus enabling the lives of his comrades to be saved.

B.E.M. (Mil.)

Sgt. A. E. BONNER, R.A.F.—In August, 1944, an aircraft, after participating in an operational sortie, returned to base with a 500lb. bomb on board, fitted with a long delay fuse which was armed. The bomb was removed to the fused bomb area, where it was expected to explode approximately six hours later. Some hours later the bomb had not exploded, and a bomb disposal squad, under the direction of Sgt. Bonner, was then detailed to demolish it. The work was given high priority in view of urgent operational requirements. This attempt, however, proved unsuccessful. In view of the urgent need to render the airfield serviceable, Sgt. Bonner returned to the bomb and, displaying complete disregard for his own safety, laid a further charge. This proved successful and the bomb detonated. Sgt. Bonner's courage and devotion to duty on this occasion set a fine example.

Sgt. J. G. FLOCKHART, R.A.F.V.R., No. 490 (R.N.Z.A.F.) Sqn.—Sgt. Flockhart was the flight engineer of a Sunderland aircraft which, owing to engine failure, was forced to alight on the sea in July, 1944. The aircraft was taken in tow in very bad sea conditions as a minimum swell of 25ft. prevailed. Three days later the starboard float became partially waterlogged. Sgt. Flockhart, although suffering from sickness, volunteered to be lowered on to the float. With lifelines attached to him, he managed to reach the float and succeeded in emptying the front three compartments. Whilst attempting to empty the aft compartment Sgt. Flockhart was carried away by the swell. He managed to climb back on to the float, but was then temporarily stunned by a wave which hit him in the groin. As it was impossible for him to do anything further, Sgt. Flockhart was ordered back to the mainplane. Later during the same day, when the float again became almost waterlogged, Sgt. Flockhart again volunteered to go on to the float. On this occasion he refused a life-saving jacket, as this impeded his work. After a short while the pump worked very badly and all attempts to repair it failed. Water re-entered the float quicker than it could be pumped out. Undeterred, Sgt. Flockhart remained on the float for approximately thirty minutes. During this time the water came up to his neck and, eventually, over four feet of the wing became immersed. Sgt. Flockhart was too exhausted to get back on to the main plane unaided, and, after he had been assisted back, the aircraft was abandoned. The fact that it had been possible to tow the flying boat 180 miles was due in a great measure to the fortitude and devotion to duty displayed by this airman. Had not the seas been so heavy his efforts would have

TO SPOT JAPS: Mosquito XVI P.R. aircraft are now operating from Bengal. The nearest Mosquito is being fitted with a new Merlin 72 engine.

SERVICE AVIATION

enabled the aircraft to weather the remaining 70 miles to safe anchorage.

Cpl. H. V. FLOOK, R.C.A.F.—One night in September, 1944, Cpl. Flook, an aero engine mechanic, was on duty in a hangar when a Halifax aircraft crashed into some nearby workshops. The aircraft immediately burst into flames and the heat became intense. Cpl. Flook, together with other airmen, ran to the scene of the crash. By now the ammunition in the aircraft was exploding and M.T. vehicles in the vicinity were catching fire. As Cpl. Flook approached the burning aircraft a member of the crew came stumbling from the wreckage. His upper clothing was on fire. Cpl. Flook tore off the airman's burning clothes, wrapped his own tunic around him and passed him to some other helpers. Then, seeing another member of the crew struggling amongst the wreckage, he ran to his assistance. After some difficulty Cpl. Flook extricated the airman, tore off his burning garments and led him away to safety, just before the petrol tanks exploded. In the face of great danger Cpl. Flook displayed outstanding courage and set an inspiring example to all.

L.A/C. J. W. BUTTON, R.A.F., No. 240 Sqn.—In January, 1944, L.A/C. Button was serving as a marine fitter on a pier when an explosion occurred on board a refueller, containing 2,000 gallons of aviation spirit, berthed alongside. L.A/C. Button observed an airman who was unconscious and lying in the cockpit of the craft, which was enveloped in flames. Without hesitation he immersed himself in the water in order to wet his clothing and then, despite the grave possibility of a major explosion occurring, he forced his way through the fierce flames into the cockpit of the refueller and dragged the airman to safety. By his outstanding determination and complete disregard for his personal safety, L.A/C. Button was instrumental in saving the life of a comrade.

Roll of Honour

Casualty Communiqué No. 485.

THE Air Ministry regrets to announce the following casualties on various dates. The next of kin have been informed. Casualties "in action" are due to flying operations against the enemy; "on active service" includes ground casualties due to enemy action, non-operational flying casualties, fatal accidents and natural deaths.

Of the names in this list, 153 are second entries giving later information of casualties published in earlier lists.

Royal Air Force

KILLED IN ACTION.—Flt. Sgt. K. J. Aspell; W/O. G. Duffey; Sgt. D. Evans; Sgt. R. C. W. H. Harvey; Sgt. M. B. Henley; Sgt. B. Hudspeth; Sgt. F. Hughes; Sgt. C. J. Jauncey; Flt. Sgt. G. L. Lovegrove; Sgt. O. A. Parry; Sgt. L. T. Woodward; F/O. H. Worden.

PREVIOUSLY REPORTED MISSING, BELIEVED KILLED IN ACTION, NOW PRESUMED KILLED IN ACTION.—Sgt. T. Adair; Flt. Sgt. H. W. Brandon; Sgt. J. McL. Campbell; F/O. J. Fenley; Flt. Sgt. K. Knight; Sgt. H. F. Moroni.

PREVIOUSLY REPORTED MISSING, NOW PRESUMED KILLED IN ACTION.—Sgt. T. G. Berry; Act. Sqn. Ldr. R. D. Campling, D.S.O.; Act. Flt. Lt. R. J. H. Clayton; P/O. K. J. Coates; Flt. Sgt. A. Craven; Sgt. J. F. M. Davies; Sgt. J. H. Duncan; Flt. Sgt. C. R. Farman; Sqn. Ldr. H. W. Goule, D.F.C.; Flt. Sgt. J. Green; P/O. E. T. Hargreaves; Flt. Sgt. W. W. Harrington; F/O. J. C. Horthill; Sgt. H. S. Howie; Sgt. W. J. Huntley; Flt. Sgt. T. F. Johnston; Sgt. S. Jones; P/O. F. M. Kelleher; Sgt. H. G. Keymer; Flt. Sgt. J. A. Knowles; Act. Flt. Lt. D. F. Langham; Sgt. P. M. Lees; Sgt. A. G. Lovsay; Flt. Sgt. A. K. L. Lyon; Flt. Sgt W. H. McCormick; Sgt. F. Middleton; F/O. D. H. P. O'Brien; Sgt. G. J. O'Brien; Flt. Sgt. W. A. Pavey; Sgt. C. A. Pinder; Sgt. K. D. Pitman; Sgt. D. W. Price; W/O. C. E. Quinn, D.F.M.; Sgt. R. Redfern; Flt. Sgt. D. Renton; F/O. R. J. Robinson; Sgt. J. W. Scott; Sgt. J. Stobo; Sgt. J. W. Swann; Sgt. J. Taylor; P/O. J. F. Ward; F/O. N. J. Warfield, D.F.M.; Sgt. G. F. White; Sgt. H. W. Williams; Flt. Sgt. C. J. Withers.

PREVIOUSLY REPORTED MISSING, BELIEVED KILLED IN ACTION, NOW REPORTED KILLED IN ACTION.—F/O. J. Ralph.

PREVIOUSLY REPORTED MISSING, NOW REPORTED KILLED IN ACTION.—Flt. Sgt. G. Harrison.

WOUNDED OR INJURED IN ACTION.—W/O. N. H. Figott.

DIED OF WOUNDS OR INJURIES RECEIVED IN ACTION.—Sgt. G. P. Kenny.

MISSING, BELIEVED KILLED IN ACTION.—Flt. Sgt. R. Brown; Flt. Sgt. R. L. Clements; Flt. Lt. D. R. Wallace.

MISSING.—Flt. Sgt. J. Adams; Flt. Sgt. E. E. Ambler; Sgt. C. Ashley; Sgt. A. C. Ayres; F/O. F. V. Bainbridge; Flt. Sgt. D. H. Baker; Sgt. H. J. Bate; L.A/C. R. A. Bates; Flt. Sgt. A. S. Booth; Flt. Sgt. P. J. F. Brockman; Flt. Lt. H. W. Castle; Act. Cpl. F. Cawley; L.A/C. W. Charnley; Sgt. H. Clayton; Flt. Sgt. L. J. Coles; Flt. Sgt. B. Collinson; A/C.1 A. Crofts; L.A/C. E. L. Davies; L.A/C. W. G. Dodds; Flt. Sgt. S. Eccleston; Sgt. A. V. Evans; L.A/C. I. E. Evans; Sgt. K. Farnden; F/O. R. W. J. Fennell; Sgt. J. J. Franklin; L.A/C. K. T. Fuller; Flt. Sgt. A. H. Gribble; Flt. Sgt. D. C. Gurr; Sgt. J. Hall; F/O. D. F. Haste; Flt. Sgt. D. C. N. Hearn; L.A/C. J. A. Holt; Sgt. J. H. Holt; Sgt. T. J. Jones; L.A/C. J. P. Kinge; P/O. E. A. Lampkin; L.A/C. W. Lawson; A/C.2 R. G. Lewis; Sgt. J. G. McIlveneye; L.A/C. L. H. Mace; Sgt. D. E. Martin; L.A/C. A. J. Moore; A/C.2 J. Morris; F/O. P. D. Mullett; F/O. E. H. Norman; Sgt. D. C. Orme; L.A/C. I. H. Parsons; Flt. Sgt. A. Reid; Sgt. N. Rowe; Sgt. J. D. Rushworth; Sgt. P. C. Russell; Sgt. G. M. Sampson; Flt. Sgt. L. J. Sanderman; L.A/C. P. J. Shead; Flt. Sgt. W. J. Sheppard; Sgt. R. A. Smith; F/O. J. W. Underhill; W/O. D. G. Venn; P/O. B. J. Wallnut; Flt. Sgt. R. Watson; Flt. Sgt. M. J. Whiteley; Cpl. A. W. W. Wood; Sgt. T. L. Wright.

KILLED ON ACTIVE SERVICE.—L.A/C. G. J. Ash; Sgt. R. H. Biddiss; Act. Sqn. Ldr. H. S. Bouchier; L.A/C. W. J. W. Canning; A/C.2 D. G. Carlson; Flt. Sgt. G. Cooper; L.A/C. H. Craven; Sgt. H. Daniel; L.A/C. J. C. Davies; Air Vice Marshal G. G. Dawson, C.B., C.B.E.; P/O. G. K. R. Gwalchmai; A/C.1 R. Hilditch; L.A/C. C. F. Hughes; Flt. Sgt. T. Keenay; L.A/C. H. Lightfoot; Group Capt. E. H. McDonald; F/O. W. C. Mann; P/O. J. C. Mentiply; L.A/C. J. A. Middlemiss; Flt. Sgt. J. T. Muncer; L.A/C. R. D. Nicholls; A/C.2 R. J. Owen; F/O. I. H. A. Park; L.A/C. R. H. Partridge; Wing Cdr. A. C. Pearson, D.F.C.; F/O. J. H. Povey; L.A/C. J. H. Price; Sgt. D. R. Puttick; L.A/C. P. H. Seaman; L.A/C. J. H. Shickle; F/O. G. H. J. Smith; Flt. Sgt. W. D. Smith; Sgt. R. P. St. Leger; L.A/C. F. H. G. Tucker; Cpl. R. Wheeler; Wing Cdr. C. S. Wynne-Eyton, D.S.O., A.F.C.

PREVIOUSLY REPORTED MISSING, NOW PRESUMED KILLED ON ACTIVE SERVICE.—Sgt. R. F. Allcorn; Sgt. P. F. Hornbrook; Flt. Lt. W. R. Wells.

WOUNDED OR INJURED ON ACTIVE SERVICE.—L.A/C. F. Arkwright; Flt. Lt. J. F. Beadle; Flt. Sgt. W. S. Gould; Flt. Lt. A. A. MacGibbon; Flt. Lt. A. F. Minnis, D.F.C.; L.A/C. E. W. J. Payne; Sgt. R. J. Poole; L.A/C. E. A. Ransom; P/O. D. A. L. Smout; F/O. J. R. M. Standen; Flt. Lt. H. E. Tolman.

DIED OF WOUNDS OR INJURIES RECEIVED ON ACTIVE SERVICE.—W/O. G. W. Blackwell; Flt. Sgt. D. F. Stroud; Cpl. R. Wylde.

DIED ON ACTIVE SERVICE.—Sgt. J. C. Anthony; A/C.1 F. J. Brennan; L.A/C. W. Brewster; F/O. G. A. Caton; L.A/C. G. E. Chapman; L.A/C. A. C. Coward; L.A/C. F. E. Crouch; L.A/C. B. J. Duell; Cpl. J. W. Edwardes; Cpl. G. Innes; Cpl. W. B. Jackson; L.A/C. D. Robson; L.A/C. G. W. Rowley; Air Comdre. T. G. Skeats, C.B.E.; Cpl. G. W. Webb; L.A/C. J. Whitehorn.

PREVIOUSLY REPORTED MISSING, NOW REPORTED PRISONER OF WAR.—Flt. Sgt. D. A. Farrington; Flt. Sgt. E. A. Haddock.

Royal Australian Air Force

KILLED IN ACTION.—Flt. Sgt. R. N. Harding; W/O. A. J. Hynes; F/O. W. W. Osborne.

PREVIOUSLY REPORTED MISSING, BELIEVED KILLED IN ACTION, NOW PRESUMED KILLED IN ACTION.—Act. Flt. Lt. W. J. Donner, D.F.M.; Flt. Lt. K. G. C. McCallum; F/O. J. P. Raffen.

PREVIOUSLY REPORTED MISSING, NOW PRESUMED KILLED IN ACTION.—Flt. Lt. W. G. Baldwin; F/O. J. P. Bird; Flt. Sgt. F. S. Carran; F/O. W. L. Clemo; W/O. J. I. Goodwin; Act. Flt. Lt. N. W. Kilsby; Flt. Lt. A. F. McKinnon, D.F.C.; Act. Flt. Lt. R. J. Mortimer; Flt. Sgt. B. K. Maunsell; W/O. K. E. Rimington; Flt. Sgt. J. D. West; P/O. I. C. Young; F/O. A. H. Will.

WOUNDED OR INJURED IN ACTION.—Act. F/O. C. D. Mattingley.

MISSING.—Flt. Sgt. H. B. Armstrong; P/O. F. M. Burrows; F/O. N. E. Butler; F/O. M. C. Gray; F/O. W. A. Greenshields; W/O. R. W. Lett; F/O. N. J. M. Manfred; P/O. R. J. O'Sullivan; Flt. Sgt. E. A. Parry; W/O. E. Smith; Flt. Sgt. R. S. Stickland; W/O. W. J. L. Whale.

KILLED ON ACTIVE SERVICE.—Flt. Sgt. W. H. Daniel; W/O. J. B. McConat.

DIED OF WOUNDS OR INJURIES RECEIVED ON ACTIVE SERVICE.—W/O. I. G. Hardy.

DIED ON ACTIVE SERVICE.—F/O N. A. Marsh, D.F.C.

Royal Canadian Air Force

KILLED IN ACTION.—F/O. W. S. Cowan; Flt. Sgt T. V. Flint; Flt. Sgt. R. A. Smith.

PREVIOUSLY REPORTED MISSING, BELIEVED KILLED IN ACTION, NOW PRESUMED KILLED IN ACTION.—Act. Sqn. Ldr. D. G. E. Ball; P/O. D. Bonokoski; P/O. A. Brooks; Flt. Lt. G. J. Chequer; P/O. S. Einarsson; F/O J. A. Frampton; W/O. J. T. Hill; F/O. M. N. MacDonald; P/O. W. A. Park; F/O. J. V. Pearl; P/O. K. Smith.

PREVIOUSLY REPORTED MISSING, NOW PRESUMED KILLED IN ACTION.—W/O. L. J. Adair; W/O. L. D. Annis; F/O. J. W. Astbury; F/O. J. J. Baker; P/O. A. A. Balcombe; Sgt. R. A. Barr; W/O. W. Beckthold; W/O. P. P. Blazeiko; P/O. J. M. L. Bouvier; P/O. R. J. Bradley; Flt. Sgt. C. P. Brown; Flt. Sgt. C. M. Carr; P/O. J. J. M. Couture; F/O. R. W. Dawe; Flt. Sgt. W. D. DeMolitor; Sgt. N. A. Dixon; F/O. G. R. Drimmie, D.F.C.; P/O. P. H. Ewing; P/O. H. A. Floren; P/O. R. M. Furman; Flt. Sgt. W. H. Garbutt; F/O. J. F. Gilbey; F/O. P. F. L. Glynn; F/O. M. Gnius; F/O. J. D. Hawkins; W/O. W. H. Hoppus; Sgt. E. C. Houlding; Flt. Lt. A. G. Jira; F/O. L. T. J. Kelly; W/O. F. A. Larsen; Sgt. R. Losa; F/O. E. A. McCorkell; F/O. D. A. MacDonald; P/O. J. C. MacGillivray; Flt. Sgt. J. G. McInnes; Sgt. W. E. McKee; F/O. E. L. MacKeigan; F/O. R. J. McMehen; Act. Flt. Lt. W. J. Maitland, D.F.M.; Flt. Sgt. M. Marks; Flt. Sgt. V. L. Miller; Flt. Sgt. J. H. T. Monteith; Sgt. J. R. Morgan; Sgt. B. R. Morrison; F/O. A. R. Pagan; F/O. D. R. Parker; F/O. J. F. Parker; Flt. Sgt. R. F. Peterson; W/O. K. E. Riddell; W/O. K. G. Rolfstad; F/O. B. A. Russell; Flt. Sgt. G. H. Scott; F/O. J. J. H. O. Souaillard; Flt. Lt. L. G. Speyer; F/O. E. B. Stiles; Sgt. P. F. J. Sykes; F/O. H. A. Taylor; F/O. W. Thatcher; F/O. J. R. Wardrope; F/O. V. M. Warwick; Flt. Sgt. R. N. Weir; P/O. L. G. Wilson.

WOUNDED OR INJURED IN ACTION.—F/O. W. E. Harris; Flt. Sgt. D. H. Lanctot.

DIED OF WOUNDS OR INJURIES RECEIVED IN ACTION.—F/O. J. L. Allan, D.F.C.

MISSING.—Flt. Sgt. R. W. Carroll; F/O. E. T. Coles; P/O. G. F. Dawson; F/O. K. D. Farrow; F/O. D. R. Hardy; F/O. J. B. Johnson; Flt. Sgt. J. E. Leaman; Sgt. R. R. H. Schnaufer; Sgt. N. L. Smith.

PREVIOUSLY REPORTED MISSING, BELIEVED KILLED ON ACTIVE SERVICE, NOW PRESUMED KILLED ON ACTIVE SERVICE.—Flt. Sgt. S. M. Craig.

PREVIOUSLY REPORTED MISSING, NOW PRESUMED KILLED ON ACTIVE SERVICE.—P/O H. C. Dixon.

KILLED ON ACTIVE SERVICE.—Sgt. N. J. Anderson; Sgt. J. E. Armstrong; F/O. G. L. O. Berg; P/O. N. H. Boss; Sgt. J. Gamborski; Flt. Lt. R. L. Garvie; Sgt. G. F. Higgins; Sgt. E. J. Pridham.

DIED ON ACTIVE SERVICE.—Sgt. J. J. L. P. Dion.

Six of the first R.A.F. men to be released from German prison camps by the Russians. They are, left to right: Sgt. Waters, P/O. Brooks, Flt. Sgt. McPhail, W/O Nevines, Flt. Sgt. Tweddle and Flt. Sgt. Archibald.

Royal New Zealand Air Force

KILLED IN ACTION.—P/O. C. Agnew; Act. F/O. G. R. Flood; Flt. Sgt. W. R. Ingram; P/O. V. W. Mathias; Flt. Lt. E. K. Necklen.

PREVIOUSLY REPORTED MISSING, BELIEVED KILLED IN ACTION, NOW PRESUMED KILLED IN ACTION.—P/O. C. S. Benson.

MISSING.—Flt. Lt. A. S. Anderson; F/O. J. G. Anderson; F/O. J. N. Clark; Act. Flt. Lt. F. G. Sanders; F/O. C. Stevenson; Flt. Lt. J. W. Taylor.

PREVIOUSLY REPORTED MISSING, NOW REPORTED PRISONER OF WAR.—F/O. A. B. Cunningham.

South African Air Force

KILLED IN ACTION.—Lt. J. E. Begbie; Lt. D. C. Bosch; Lt. B. J. Eaton; 2/Lt. G. C. Murray.

PREVIOUSLY REPORTED MISSING, NOW REPORTED KILLED IN ACTION.—Lt. C. T. M. Cockburn; Lt. V. C. Richards.

MISSING.—Maj. T. C. MacMurray.

KILLED ON ACTIVE SERVICE.—Lt. J. W. Swart.

Air Transport Auxiliary

Third Officer James Waldron Brown, A.T.A., killed in the course of ferrying duties in England.

First Officer Frank Hill, A.T.A., killed in the course of ferrying duties in England.